# SCIENCE

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## FROM HIGH SCHOOL TO COLLEGE.*

OUR system of education, as it exists today, is based on the earnest conviction of the people that American boys and girls should be compelled to go to school to get the foundation of a good education, and should have the opportunity to continue their studies in secondary schools and colleges if they so desire. It is only in the states west of us that the college and university are a part of the system of free education of the state, but here also there is such ample provision by the older colleges for free tuition for needy students that one no longer regards poverty as a barrier to the higher education.

But the college and university will always be for the few favored ones who have the time as well as the aptitude for advanced study. For the masses the high school remains the capstone of our educa-

* An address delivered at the dedication of the new buildings of the Central High School of Philadelphia, November 22, 1902.

tional fabric, and by reason of the extent and variety of its curriculum, broader indeed than the college course of fifty years ago, is not inappropriately called the 'people's college.'

The improvement of the high school, as an educational organization, has been brought about by many agencies. Physics, chemistry and biology have appropriately found a place in our schools, as they have in the lives and thoughts of all intelligent people. The progress in educational methods and in the facilities of instruction, particularly in the laboratories for practical work, has also strengthened the courses of study and brought a great intellectual stimulus into the pupils' lives.

But there has been another agency at work, outside the high school, namely, the advance in college entrance requirements, and the throwing back upon the schools studies formerly pursued in the college. Whether this was a wise measure on the part of the colleges it is now not worth while to discuss, since it is an accomplished fact; it has, at least, increased the value and dignity of the high school course to such a degree that the graduates of our best-equipped and best-manned high schools are as well prepared for their life's work as were the college graduates of the middle of the last century.

The college after having thus put upon the schools an additional year's work, has not been as liberal as it might have been in recognizing the efficiency of this work. Most of our larger eastern colleges still insist on their own entrance examinations. This makes a break in our educational system which affects unfavorably the high school course preparatory to college, inasmuch as this course is then too apt to have for its aim the successful passing of examinations rather than a serious preparation for advanced work. This is an old and much-discussed question, and I touch upon it now to assert my conviction that it is practicable to throw such safeguards around the system of certification that the diploma of graduation, accompanied by the personal statement of the principal, will become much better evidence of a boy's fitness to enter on college work than a few days' written examination can be. Entrance examinations show but little more than that a boy had or had not, on the days of examination, writing under peculiarly trying circumstances, a certain knowledge of mathematics, history, language and science. Whether or not he is likely to prove a diligent student, with tastes and aptitude for his work, the college gets no indication from the examination papers, and seems to be indifferent to these qualifications.

The western states find no difficulty in articulating the high school and college in their educational system, but in the eastern states, in addition to the supposed difficulties in this articulation, there seems to be also a feeling that the dignity of a college is better maintained by insisting on its own examinations, a notion which rests on a mistaken idea of the reason for the existence of colleges. If the time of the examination were extended, so that the college could determine by actual experience the fitness of the applicants to undertake profitably college work, there would be a rational basis for an opinion as to this fitness. Why should not all secondary school graduates, who are vouched for by the principals of these schools, be admitted and given a trial until the Christmas vacation? In other words, let the entrance examination extend over three months instead of three or more days. At the end of this period (during which there will be every incentive for the earnest boy to prove his fitness) let those who show they are unprepared, through lack of knowledge or aptitude or industry, be returned to the school

whence they came or advised to abandon a college career. This plan would not necessarily result in the overcrowding of the freshman class with poorly prepared or immature boys, for the consequence to the principal of a high school of having boys thrown back on his hands would be too serious. The character of the work which secondary schools are doing in teaching and training young men should be more fairly judged than is possible by a few days' written examination. Let us hope that some method may be devised, that this may be accomplished and the good work of the schools find more abundant recognition.

Although the high school offers an admirable preparatory course for college, this course is not its primary object, which is rather to give to boys and girls during the years of adolescence a broader view of life than they are capable of comprehending in the grammar school period, and an intellectual stimulus which shall abide with them in after life.

Many elements enter into its efficiency. The location of the school and the building itself has much to do with it. Bright, large, well-ventilated rooms and cheerful surroundings, such as these great new buildings possess, have a notable influence in promoting good teaching and quick apprehension. Its efficiency is further closely connected with the completeness of its equipment—its laboratories of chemistry, physics and biology, and its libraries. But far above its material possessions rises the teacher as the most potent influence for good work. My experience is probably not different from many other college officers, in observing that the principals of many poorly equipped schools send boys to college with a uniform stamp of high scholarship which many of the richer and better equipped schools fail to equal.

It is often said that the purpose of the school is to make good citizens by giving the pupils a sound foundation of general and useful knowledge and by guiding their young minds in the ways of truth, justice and righteousness. To the idealist in education it is character-building that should be kept in mind in all the teaching and discipline of the school. And when one reads the current educational literature he is almost led to believe that this result can be brought about by purely pedagogical methods, and that the millennium must arrive in the course of another generation. In this conception of education are we not putting on the schools the responsibility which belongs to the family, the society and the church? The instruction which we give our youth in history, civics and ethics is necessary for the intelligent citizen who wishes to do his full duty in civil life, but it does not supply the incentive to make him do his duty. This is sufficiently obvious, and yet it seems necessary to say it from time to time to tone down the rhapsodies of the theorists in education over the purposes and possibilities of public schools.

Character is the result of heredity and environment. To apportion the relative values of these influences in any case is no easy matter. If a school boy proves incorrigible it is generally attributed to heredity; if he becomes tractable, to environment—so easily do we let ourselves be persuaded as to the beneficial effect of our influence.

Three results we have a right to expect from our schools, namely, that the students shall acquire a certain amount of useful knowledge, that they shall become genuinely interested in one or more of the subjects they have been studying, and that they shall learn to think for themselves. The first can be accomplished under almost any system of teaching. Grammar, history and the descriptive sciences can be taught

like the multiplication table, and often are, but it is only when subjects are pursued with interest that they become permanently profitable. And this leads directly to the question, shall the elective system be introduced into the high schools? The answer is so far simple, that a choice must necessarily be made among the great number of subjects available, but how that choice shall be made is not so easily answered.

The most sensible solution to this much-discussed problem of high school curriculum would seem to be the selection of a certain course of study by the boy or his parents, and the prescription of the studies within the course by the faculty. The development of interest is properly made the corner stone of our modern educational system, but in our efforts to attain this end we are in danger of overlooking the fact that side by side with interest should be the consciousness of power and mastery. The latter are not acquired by following the lines of least resistance.

The likes and dislikes of a school boy should not be taken very seriously in laying out his course of study, since they are too often founded on ignorance of the real nature of the subjects he would elect or reject. The interest that is developed in a subject, as the result of hard, patient study, is of infinitely more worth than the interest which rests on a passing fancy. The former is associated with a feeling of conquest and power, and with a sense of having gotten to the bottom of things; the latter is too often an interest which is satisfied with what is on the surface.

The current drift of educational thought is towards the perfection of methods and of systems of teaching. It is one of the happy signs of the times that teachers of all grades and of all degrees of experience are trying to tell their brother and sister teachers how this and that subject should be taught. A happy sign, in that it gives evidence of the deep and absorbing interest on the part of the hosts of men and women throughout our country engaged in this noble work. And yet these sincere and devoted souls, who have their daily reward in the bright and responsive faces of their pupils, generally overlook the fact that their success is not due so much to their methods as to themselves. Teachers are born, but they can also be made, not by studying rules and routine, or by the imitation of the ways of others, but through the inspiration which comes from patient, loving service.

'The whining school boy—creeping like a snail unwillingly to school' is not unknown in our day, but sympathetic treatment and bright surroundings have done much to take the terror from the school associated only with the task and the rod. Carlyle makes his hero in Sartor Resartus say: "My teachers were hide-bound pedants without knowledge of man's nature or of boys' or of aught save the lexicons and quarterly account books. How can an inanimate mechanical gerund-grinder, the like of whom will, in a subsequent century, be manufactured at Nürnberg out of wood and leather foster the growth of anything, much more of Mind, which grows not like a vegetable (by having its roots littered with etymological compost) but like a spirit by mysterious contact of spirit; thought kindling itself at the fire of living thought? How shall he give kindling in whose inward man there is no live coal, but all is burnt out to a dead grammatical cinder? The Hinterschlag professor knew syntax enough and the human soul this much: that it had a faculty called Memory, and could be acted on through the muscular integument by appliance of birch rods."

The ideals of education, looking to the development of the whole man, find full expression in the philosophers of the six-

teenth, seventeenth and eighteenth centuries. For the attainment of these ideals private tutors stood in the place of the school teachers of our day, and education was necessarily confined to those who could afford this luxury. The ideals of to-day are not lower, but they are more difficult to attain in the class-room where the teacher has two score or more pupils at one time. It is the inevitable dilution of personal influence as classes increase in size which prevents the school of to-day from becoming the power for good it might be if the teacher's strength were not exhausted in hearing and marking recitations and maintaining order. There are not, I fear, many school boards that would appreciate the suggestion of increasing the teacher's efficiency by limiting the number of his pupils. This efficiency is in inverse proportion to the number of pupils; perhaps it might be safe to say the square of the number, so rapidly does the personal influence decrease when a limiting number is overstepped. Thus does penuriousness, combined with ignorance, on the part of city councils and of school boards, often defeat the cause which they profess to maintain.

Two tendencies are now distinctly marked in our higher education, namely, the demand of the professional schools that the baccalaureate degree shall be required for admission, and the willingness of the colleges to shorten the time in which the baccalaureate degree can be obtained. There was a time, not very long ago, when theology was the only profession for which the A.B. degree was considered necessary. Now law and medicine are demanding this preparation, and it will not be long before engineering and the related technical pursuits will claim recognition of their professional character. And on the educational horizon we see the rise of a new profession—commerce—which will doubtless in its turn demand a similar recognition.

Two influences are at work in requiring the baccalaureate degree as a preparation for law, medicine and engineering; one is to give a greater dignity to these professions, and the other is the conviction, based on experience, that narrowness in education is accompanied with a narrowness of outlook which prevents a full development of a man's powers in his special line of work. By this increased requirement we are brought to face the practical question whether there is a gain in professional equipment to compensate for the time consumed; for nearly half a lifetime may be consumed (including the apprentice years) in getting ready for life's work.

It is this question, which carries its answer with it, that has led colleges to abridge the time within which the A.B. degree can be had, some by condensing the four years' work into three, others by admitting professional studies into the last two years, and still another by deliberately casting off two years' work. The significance of the A.B. degree has been so far modified in American colleges in the last generation that it no longer implies any definite course of study. It is, therefore, meaningless for the professional schools to insist upon it as a necessary preparation for advanced work. What these schools really need, and what they should require, is satisfactory evidence that the applicant possesses the necessary knowledge and the necessary maturity to undertake profitably the work involved. It may well be that a high school graduate would prove by these tests to be better prepared to enter schools of law and medicine than many a college graduate. The faculties of the professional schools should not try to evade the responsibility which belongs to them of ascertaining by some tests the fitness of the applicants to undertake their work.

By making the possession of the A.B. degree the only test of fitness many a well-prepared man will to-day be rejected and many a poorly prepared man admitted. Should we not arrive at a conclusion satisfactory to both college and professional school if a six years' combined course should lead both to the bachelor of arts and (in the case of the law) to the bachelor of laws? Let me here quote briefly from a notable address by Mr. John H. Converse, of this city, delivered on Founder's Day at Lehigh University in 1896:

"For an institution proposing to do full university work, I would formulate a course of five or six years as might be required. For one half or more of such course let the curriculum deal, as at present, with the humanities, the sciences and all that makes for the broadest education properly so called. At a fixed period, say at the end of three years, let the student elect the professional, business or scientific course which will, as far as possible, qualify him for his proposed life work. The general course should thus eventually branch out in various directions such as theology, engineering, medicine, architecture, law, chemistry, agriculture, business, transportation. To accomplish many of these specialties to-day in connection with a college course requires six or seven years. A combined university course, such as is suggested, would, therefore, be an economy of time. It would measurably avoid duplicating some subjects which are common to both a college and a professional course. The degree finally conferred should recognize the general culture as well as the special training and would, therefore, differentiate such a curriculum from that of an ordinary professional or technical school."

This may well be called the ideal professional education, and could be entered on at the age of eighteen and completed at the age of twenty-three or twenty-four. But I still hold that graduates of our best high schools should not be denied admission to professional schools if they can prove their fitness as regards both knowledge and maturity.

The attempt to readjust our educational system in the interest of professional education meets with vigorous opposition from those who fear that it means the passing of the college, with all its good traditions and aims. I do not think their fears are likely to be realized. For a large number of those who intend to enter on professional life this shorter cut is necessary. But there will always remain a not insignificant remnant who, for love of study, will lay deep and broad the foundation of knowledge based on the humanities and on the physical sciences. The choice spirits whose lives are brightened with the finest products of ancient and modern thought and learning will always be with us to keep up the tradition of pure scholarship in our colleges and universities. And there will still be many who, having the time and means to take the lengthened course, will enter the professional schools after the full college course, and the professions will still be graced by men whose technical knowledge is based upon ripe learning and culture.

One more aspect of college and university life needs to be considered. The vital and essential part played by the lengthening of the period of infancy in the development of the human race, first pointed out by Mr. John Fiske, has been happily made use of by Dr. Nicholas Murray Butler in expounding the 'Meaning of Education.' But, it may fairly be asked, is the artificial prolongation of this period of irresponsibility, which wealth has made possible, been accompanied by increased benefits to the race? Does it not rather result in enervating than in strengthening of

power and purpose? It is a significant fact that the college graduate of the middle of the last century was about four years younger than the college graduate of to-day. Many of the great men of the nineteenth century, men whom it is our delight to honor as representing what is best and highest in private life and public service, were graduated at seventeen or eighteen years of age. Has there been a corresponding gain in maturity and in intellectual and moral force in the graduate of to-day to compensate for the additional years of study?

The American college at the beginning of the twentieth century stands for what is highest and broadest in learning and scholarship and research. Never before was such an opportunity offered to the earnest and thoughtful student, and never before has there been such a large number to avail themselves of this opportunity. The college of to-day is an infinitely greater power for usefulness in its increased facilities for instruction, both material and intellectual, than the college of fifty years ago, and yet its graduates, taken as a whole, can not be said to excel the product of the older college in intellectual force, maturity of judgment and integrity of purpose. If I am right in this assumption, may we not find the explanation in the fact that there has been grafted on to the life of the older college a new and different life, which concerns itself more with the incidental advantages of a residence at college than with those which are connected directly with study? The social features of modern college life are esteemed by many to be of greater benefit to a young man than attendance in lecture room and laboratory. From the academic atmosphere in which he lives he absorbs much that resembles, if it does not actually partake of the nature of culture, and the pastimes and sports relieve pleasantly the monotony and drudgery of the class-room. If, while enjoying these careless years, enough scholastic credits can be gained to secure the degree, the college career may be said to be crowned with a fair measure of success. It will not be denied that three or four years, such as I have depicted, may be a good thing for many a young man who has not the aptitude or the moral purpose to pursue a serious course of study. He has, it may be, acquired a certain familiarity with the amenities of life which makes him an agreeable and acceptable member of polite society.

But, let it be asked, is it fair to burden an institution of learning with young men of this kind, and thereby try the patience and tax the strength of the teachers who make up its faculties, young men whose college records show a series of failures supplemented, after many trials, with the conventional passing grades? What an amount of vigorous life and energy of the teacher would be set free and available for study and research if all the students were at least earnest in their work, and how much more efficient would be their teaching.

But more important than the effect on the teachers is the effect of this life on the student himself. Are not young men unfitting themselves for the serious business of life by acquiring the habit of putting off duty for pleasure? There is nothing in the business world—in factory, store or counting-room—corresponding to making up of deficiencies or the excusing of absences. And does not the college which makes this provision for the lazy and neglectful become a party to the demoralization of character by encouraging habits which have to be eradicated before a man can become a useful member of society?

Why should it be considered unreasonable that a college should insist that those

who come within its walls to enjoy its great privileges should, as a condition of their remaining, be required to perform their daily work to the very best of their ability? "Would you," I think I hear it said, "make prigs and pedants of our young men, and take all the joy out of their college days? Life has enough sadness and tragedy; let those days at least be bright and sunny." No true pleasure was ever taken out of life by bringing a sense of duty and responsibility into it. The tragedies of life come from the neglect of duty and from the pursuit of pleasure in which no sense of responsibility abides. The careless optimism which expresses itself in 'boys will be boys' may apply to children in the lower schools, but is demoralizing when applied to men in college.

This great training ground for the higher service should maintain a standard of robust, manly character as well as of fine scholarship if it is to be a power for good in the community. When the college shall inculcate and demand that duty must come first, then all the incidentals of college life—its social pleasures, its pastimes and its sports will take their proper place and contribute normally to the symmetrical development of the whole man.

In considering the list of distinguished men who attended this great high school in their youth—distinguished in the learned professions and as scholars, philanthropists and captains of industry, of whom the city and state and nation are proud, what conclusion can be drawn as to the part which the school played in these successful careers? I think the only answer we can give is that in any school or college the good influences exerted are in direct proportion to the opportunities afforded. The prodigality with which knowledge is disseminated in our modern high school may seem like a reckless waste from the standpoint of a school board, but it is in virtue of the availability of these great and varied resources for the pupils that its great usefulness lies. Many of the pupils pass through this wealth of opportunity unaffected by it, and the little knowledge which adheres to them will be quickly lost, notwithstanding the most cunning devices of teachers to entrap their intelligence and interest. But there will always be a goodly number whose souls will be kindled by the divine fire if the right thought come at the right moment to their unfolding minds. Why should the science of numbers kindle this fire in some minds and extinguish it in others? Why do some feel the lightning strike when certain facts in science, with the generalization drawn from them, come to their consciousness? We may study the child's mind and prescribe the appropriate mental nutriment for each stage of its development, but there will always be some who refuse to be classified and remain the despair of the psychologist.

Liberal and even lavish outlay in curriculum, in equipment and, above all, in teachers is needed, that the young minds with their diverse aptitudes and tastes shall open under the most favorable conditions, and receive from the teacher and the subject an inspiration which shall last them through life.

The opportunities in equipment and curriculum offered in this school in the first decades of its history may seem to us now very humble and restricted, but there were good teachers in those days, as the results amply prove. To-day we have a great building—a noble monument to the Philadelphia Board of Education—provided with all the aids to teaching that experience has proved valuable, and a faculty of instruction of which the city and state may well be proud—a strong, safe and scholarly president, and a live, aggressive and inspiring body of teachers. That its

power for good may be in proportion to these great resources is the prayer of thousands of alumni, whose pride in its past is their hope for its future.

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*AMERICAN SOCIETY OF ZOOLOGISTS. II.*

*An Experimental Study of the Spawning Behavior of Lampetra wilderi:* JACOB REIGHARD, University of Michigan.

An attempt was made to extend Gage's excellent account of the spawning behavior of the brook lamprey, as given in the 'Wilder Quarter Century' book. Space does not permit more than a statement of results, which were obtained under the auspices of the U. S. Fish Commission:

1. Fish were numbered and a record kept of their movements and the behavior of fish removed from the nest and then released was observed, but *no constant relation was found between individual* fish and individual nests.

2. The *location of nests is determined* not by the form or character of the bottom, but by the existence beneath or in the midst of the running water of small masses of water at rest, such as occur in depressions of the bottom or behind or in front of obstructions in the stream. Small glass plates set on edge across the stream on a perfectly level bottom have such inert masses of water above and below them and, although the plates are invisible, the lampreys build nests above and below them, and this on any sort of bottom in which there are stones large enough to serve them for attachment.

3. *Sex recognition* appears to be a reaction of the male to a reaction of the female. Males, females with eggs and spent females were marked so as to be readily distinguishable. Attached males when seized by other males at once release their hold and the two fish separate. Spent females seized when attached behave like males. Females containing eggs, if seized by males while attached, retain their hold and begin at once to 'shake.' The male reacts to this movement by throwing his tail in a loop about the body of the female and then 'shaking' with her. The shaking consists in a rapid vibration of all the body behind the branchial region.

4. The loop formed by the tail of the male is always thrown accurately into the notch between the first and second dorsals of the female. In the female at the breeding season, but not in the male, the second dorsal is œdematous and is believed to serve as a support for the tail of the male during spawning. The small anal fin found in the breeding female, but not in the male, may have the same function.

*Some Experiments on the Growth of Oysters:* OTTO C. GLASER, Johns Hopkins University. (Introduced by Caswell Grave.)

The occurrence of elongated oysters on the edges of marshes and reefs in waters supporting profitable beds is a well-known but puzzling fact to the culturalist who sees such different results under similar conditions.

Among the explanations given by other workers, excessive crowding seemed to the author to be the only one borne out by his observations, but to test this view more carefully a number of experiments were made.

In one, young normal oysters were subjected by imbedding in cement to lateral pressure, and exhibited after thirty days a slight elongation, and the scolloped anterior edges common in elongated oysters.

In another experiment, to find if oysters liberated from an oppressive environment would change in shape under other conditions, it was discovered that, after forty-

eight days of improved surroundings, the relation between width and length changed from fifty-three per cent. to sixty-six per cent., the width of normal oysters of the same age being seventy-nine per cent. of the length.

A third experiment, to find the limits to the recuperative power, revealed the fact that young oysters take advantage of improved conditions more rapidly than old ones. The youngest oysters in this experiment changed in sixty days in the relation of width to length from fifty per cent. to sixty-eight per cent., whereas the oldest changed only from forty-one per cent. to forty-seven. The recuperative power of the younger ones was three times that of their seniors.

These experiments show that crowding alone explains the elongation; that young elongated oysters can with profit be transplanted to artificial beds, where, under favorable conditions, they can grow to a normal maturity and become marketable.

These experiments were conducted by the North Carolina Geological Survey in cooperation with the U. S. Fish Commission Laboratory at Beaufort.

*Growth of Lamprey Embryos in Nature:* S. H. Gage, Cornell University. (Read by title.)

*Some Points in the Life History of the Human Warble Fly:* H. B. Ward, University of Nebraska.

*Movements of the Cerebro-spinal Fluid in Cryptobranchus:* J. B. Johnston, West Virginia University.

The cerebro-spinal fluid of *Cryptobranchus* normally contains a considerable number of red blood corpuscles which serve as a convenient means of demonstrating the course of flow of the fluid when the brain ventricles are opened, the animal being under the influence of chloretone.

There is a general current which flows backward on the floor and the lower part of the side walls of the brain, and forward along the roof and the upper part of the side walls. Subordinate circuits, each more or less complete in itself, are present in the hind-brain, in the mid- and 'tween-brains and in the fore-brain. This is especially noticeable in the mid- and 'tween-brains, where there is a distinct whirlpool of corpuscles on the lateral wall. Also on the side wall of the medulla oblongata are several small whirlpools between the upper and lower currents of the main circuit. In the lobi inferiores the directions of the main circuit are reversed, so that the current flows backward on the roof of the lobes and saccus vasculosus and forward on the floor. It is possible that the three sections of the current are related in some way to the three vascular plexuses of the brain, but it is more probable that they are due to the two chief isthmuses by which the ventricles are divided into three parts.

The corpuscles have the appearance of being driven by cilia. The fact that the current is kept up after the brain is opened, and that the corpuscles are driven against the force of gravity when the brain is tilted, and the formation of whirlpools are scarcely to be explained in any other way. No such long flagella as are seen in the brain of *Acipenser*, nor any special ciliated tracts such as have been described for other forms, have been found, but apparently the whole floor and part of the side walls of the brain ventricles are covered with very fine cilia.

*On the Negative and Positive Phototropism of the Earthworm Allolobophora fœtida* (Sav.) *as Determined by Light of Different Intensities:* G. P. Adams. (Presented by G. H. Parker.)

*Allolobophora fœtida* is negatively phototropic toward light from electric incan-

descent lamps varying in intensity from 192 candle-meters to .012 candle-meter; the percentages of negative head movements referable to light of different intensities are as follows: 41.5 per cent. (192 cm.), 41.5 per cent. (90 cm.), 59 per cent. (48 cm.), 45 per cent. (31 cm.), 45.5 per cent. (12 cm.), 38.5 per cent. (5 cm.), 24.5 per cent. (1 cm.), 14 per cent. (.128 cm.), 12 per cent. (.050 cm.), 5 per cent. (.020 cm.), and 3 per cent. (.012 cm.). *A. fœtida* is positively phototropic toward an electric incandescent light of .001 candle-meter intensity. Earthworms retreat into their burrows during daytime because of their negative phototropism. They emerge at night not so much because of darkness, but because of their positive phototropism for faint light.

*The Collembola Fauna of Cold Spring Harbor Beach:* C. B. DAVENPORT, University of Chicago.

The apparently lifeless surface of the between-tide zone of this sandy beach supports a vast host of minute insects belonging to the family Poduridæ. These animals crawl out to the surface after the retreat of the tide and return again into the sand as the tide rises. The period which they spend on the surface is spent in ceaseless activity, and the direction of all this complex movement is determined by the resultant of the physical agents by which they are surrounded. They are geotactic, hydrotactic, rheotactic, thigmotactic and phototactic in the highest degree. This extreme sensitiveness of organisms closely related to the ancestors of insects is suggestive in view of the complex nervous mechanism and reactions attained by their most highly developed descendants.

*The Function of the Pearl Organs of the Cyprinidæ:* JACOB REIGHARD, University of Michigan.

Pearl organs are found in the breeding males of many fish, but only rarely in the females. The breeding behavior of three forms was studied, *Campostoma anomalum*, *Rhinichthys atronasus* and *Semotilus atromaculatus*.

The organs in all these cases are spines and in each case they were found to have a mechanical function. They are used in *Campostoma* in building the nest, in the battles of the males and in holding the females during the act of spawning. In *Semotilus* and *Rhinichthys* they are used in holding the spawning female. The method of holding the females is different in each of these three cases, but in each case the distribution of the pearl organs corresponds to this mechanical use.

*Phototaxis in Volvox:* S. J. HOLMES, University of Michigan.

In light of weak or moderate intensity *Volvox* is positively phototactic and orients itself very accurately to the direction of the rays. In swimming towards the light the anterior end of the organism is directed forwards, the body rotates on its longer axis, and deviates remarkably little from a perfectly straight course. In very strong light *Volvox* becomes negatively phototactic, swimming away from the light in very nearly a straight line. The grouping of *Volvox* in places of a certain intensity of illumination is a natural consequence of the fact that this organism is positively phototactic in weak light and negatively so in strong light. In very dim light *Volvox* shows no pronounced phototaxis, and either lies quiet or rolls about in a slow and irregular manner. In moving towards the source of light the rate of locomotion, within certain limits, increases with increase in the intensity of illumination, but, as the optimum is approached, the speed becomes gradually less. In swimming away from strong light the speed is likewise lessened as the optimum

is approached from the other side. It is difficult to explain the orientation of *Volvox* on the theory that it is brought about by differences in the intensity of illumination on the two sides of the organism. According to this view, we should expect that as *Volvox* passes from weak into stronger light its rate of speed would be decreased, but this does not occur. The explanation of orientation in this form is not so simple a matter as it might seem.

*The Blood Flow and the Structure of the Vessels in the Earthworm:* J. B. Johnston and Sarah W. Johnson.

We have previously reported the results of an experimental study of the course of the blood flow in *Lumbricus,* which showed that the circulation in this worm is not segmental, but strictly systemic. This view of the circulation opened two lines of further inquiry: What happens when the hearts are removed from the circulation by cutting off the head segments of the worm; and what is there in the structure of the blood vessels to determine the course of blood flow? A series of regeneration experiments and the study of the histology of the blood vessels have given striking confirmation of our previous conclusions.

1. In all animals from which the head segments were removed there was an enormous collection of blood in the anterior end of the worm, including the regenerated segments. Such a condition would probably not be brought about if there were a segmental circulation in the normal worm. Usually all circular vessels were crowded, but the intestinal vessels and spaces were more distended than the parietal vessels.

2. The dorsal vessel and all the vessels connected with it are provided with valves which determine the direction of the blood flow. In the dorsal vessel at the level of each septum is a pair of large, thick, flap-like valves, one attached to either lateral wall of the vessel. These valves open forward and are closed at the time of each contraction-wave. The parietal, dorso-intestinal and dorso-typhlosolar vessels are each provided with similar valves, so placed in the mouth of each vessel that the blood can flow freely into the dorsal vessel, while each vessel is closed by its valves in advance of the contraction-wave of the dorsal vessel. No valves have been found in any other vessels, but these are enough to direct the blood flow.

3. The walls of the vessels are made up of three coats: (*a*) A layer of extremely thin, flat, endothelial cells; (*b*) a connective tissue membrane containing longitudinal fibers, probably muscular; (*c*) a layer of circular muscle fibers. The valves are masses of cells connected with the connective tissue layer. The circular muscle layer is especially thickened at the valves in the dorsal and parietal vessels, and the contraction of these bands of muscle presses the valves together, completely closing the vessels. A similar mechanism in the intestinal and typhlosolar vessels has not been seen, but the valves are so placed as to open toward the dorsal vessel and to be closed by backward pressure.

*On Phyllodistomum americanum n. sp., a parasite in the Urinary Bladder of Amblystoma tigrinum Green, in Minnesota:* Henry Leslie Osborn, Hamline University.

This genus, recently founded by Braun,* has been reported from central Europe, eastern Asia and northeastern Africa, from the urinary bladders of fish and amphibia,† but has not hitherto been recognized in this hemisphere. I have found that flukes generically identical with the old world ones,

* 'Ueber Clinostomum,' *Zool. Anzeig.*, XXII., pp. 484–488, 1900.

† Looss, 94, *Distom. Fisch. u. Frosch;* Sturgis, 97, *Zool. Bulletin,* I., p. 57; Odhner, '00, *Cent. F. Bakt. u. Parasit.*, XXXI., pp. 58–69.

but specifically distinct, occur in the urinary bladder of a salamander, *Amblystoma tigrinum* Green, which is found frequently in the district near Saint Paul, Minn. The number of the parasites found in a single host is not large (two to ten and this in only six out of twenty-nine salamanders examined). The total length of the largest specimen of the parasite thus far seen is 3.5 mm., its greatest width 1.4 mm. or 40 per cent. of the length. It is thus much narrower than any of the old world forms, *P. patellare* having this ratio, 66 per cent., *P. spatula* (Odhner, '00) 63 per cent. and *P. folium* 48 per cent. One of Odhner's species, *P. unicum,* has a width of 43 per cent. of the length, according to his figures. The testes in the American form are both completely posterior to the ovary, and nearly in line one in front of the other. The testes, ovary and vitellaria are all deeply lobed. This is unlike *P. unicum,* which resembles this species in its proportions, but in which the genital organs are said to be entire or nearly so. The course of the uterus is characteristic: next the ootype there is, first on the left side a loop forward, then one backward and behind the posterior testis, then one in front of this and behind the anterior testis, then another in front of the anterior testis, then crossing to the right side in front of the ovary, first an anterior loop and then a posterior loop. This is unlike either *P. folium* or *P. patellare.* A fuller account of the anatomy of this species is in process of preparation; the name is given in view of its being the first species of the genus to be reported from this country.

*On Cryptogonimus chyli, n. g., n. sp., a Trematode from Lake Chautauqua, N. Y., with Novel Type of Ventral Sucker:* HENRY LESLIE OSBORN, Hamline University.

A very small distomid fluke (0.5–1.3 mm. in length) of decidedly aberrant structure occurs abundantly in the chyle of the black bass (*Micropterus dolomieu*) of Lake Chautauqua, New York, and in the St. Mary's River near Sault Sainte Marie, Mich. The body is cylindrical, obtusely tapering posteriorly, is covered with broad flat scales and has a large oral sucker. About the front end of the middle third of the body there is, mid-ventrally, a peculiar and unique sheath, with circular lip and sphincter muscle enclosing a chamber in which are located two entirely disconnected ventral suckers, one behind the other, with the genital pore located in the middle line between them and wholly separate from either. There is a pharynx, a very short œsophagus, the intestines reach only to the beginning of the hinder third of the body, there are two conspicuous masses of pigment (but no lenses) on either side of the pharynx, seemingly rudiments of eyes. The excretory pore is terminal, there is a large median bladder in the hinder third of the body, and a large fork from it on each side running forward to the level of the pharynx, forming there a large conspicuous hollow cavity on each side. The spermaries are oblique and near the beginning of the hinder third of the body. The ovary is near the level of the anterior spermary, the uterus passes posteriorly to the extreme end of the body, returns on the opposite side black in color from the multitudes of ova, crosses to the right side and runs to the surface, crossing over the posterior ventral sucker in its course, and joining the ductus ejaculatorius to form a very short muscular genital sinus. The vitellaria consists of a number of distinct follicles in a row laterally in the middle third of the body. A Laurer's canal or seminal receptacle seems to be present in the form of a tube connected with the oviduct near the junction of the yolk ducts, but it lacks a

communication with the exterior. There is a large seminal vesicle, but no sac; prostate cells are present, collected around the passage from the seminal vesicle to the exterior. They are not shut off by a membrane from the surrounding parenchyma. I have not as yet reached any conclusion as to the affinities of this form with the other distomids.

*Some Recent Additions to the Marine Fauna of Bermuda:* C. L. Bristol, New York University.

*Distribution of Fresh-water Fishes in Mexico:* S. E. Meek, Field Columbian Museum.

*A Comparison of the Plankton of Green Lake and Lake Winnebago:* C. D. Marsh, Ripon College.

These lakes represent the two types of deep and shallow lakes. Plankton collections were made upon them regularly for a period of two years and a half. From these collections records were made of the annual distribution of the total plankton and of the principal constituents of the plankton. For comparison a number of other lakes were visited at different periods, but upon them no continuous record was kept. The attempt was, first, to accumulate a certain number of facts in regard to the plankton, and then, second, if possible, determine some of the fundamental principles controlling the distribution of the plankton and its constituents. The distribution of the total plankton was discussed briefly, and then an account was given of the annual distribution of two or three of the more important individuals composing the plankton. Attention was called to certain interesting relations between the occurrence of species and temperature, and then the question of the balance between animal and vegetable organisms was discussed at some length.

*A Combined Locker and Laboratory Table:* Pierre A. Fish, Laboratory of Comparative Physiology and Pharmacology, N. Y. State Veterinary College, Ithaca, N. Y. (To be published, with illustrations, in *Journal of Applied Microscopy.*)

*Specifications.*—Both sides of the table are to be exactly alike. Each table will then have four doors, four drawers, each five inches deep in the clear, and eight drawers each three inches deep in the clear.

Exterior of tables and fronts of drawers are to be of selected red oak; drawer guides or slides of oak, maple or cherry; and balance of interior work of poplar.

Each door shall be hung with one pair good brass fast pin butts, and shall be fitted with an 'anti-dial' combination lock. Each table shall be fitted with eight 'standard' No. 7, all steel castors.

Except the top, all exposed work, including drawer fronts, shall be filled with silica paste filler, and shall then be finished with one coat of white shellac and one coat of Johnson's, or equally good, wax. Inside and drawers, except fronts, shall have one coat of orange shellac.

The table in question was designed for laboratory work in physiology and materia medica. The height and also the area of the table top is somewhat greater than ordinary for the reason that, in experimental physiology, it is necessary at times to have considerable apparatus upon the table, and the height is desirable because in some experiments the student can do his work better standing than sitting. The foot rest attached to the tables, in connection with a stool a trifle higher than usual (twenty-four inches), enables the table to be perfectly serviceable and entirely satisfactory for all forms of work at which it is desirable that the student should sit.

The chief advantage of the table, however, is believed to rest upon the fact that a considerable economy of space and con-

venience to the worker is subserved. The floor space covered by the table in many instances is not utilized at all, except for the work done upon the top of the table. Lockers, when necessary, have been built along the walls of the laboratory or in the hallway or in an adjoining room, thus taking up space which might be profitably utilized by wall cases containing specimens, models or general apparatus bearing upon the laboratory course. Students often pass to and fro from table to locker, causing more or less jar and vibration, especially annoying if microscopical work is going on. Such an arrangement is doubly inconvenient. It is annoying to the student to be obliged to go from table to locker. It is also annoying to his fellow workers to have him do so.

The combined lockers and table obviates these disadvantages. Each table contains four lockers, and two students can work at one table and have their apparatus right at hand. Twelve tables will provide lockers for forty-eight students, and twenty-four students can work at the tables at one time.

The table would appear to be useful for biological work in general, although in certain cases a proportionate change in dimensions may be desirable.

The cost of the combined locker-table is less than the total cost of a table and four lockers built separately. In lots of one dozen, the combined locker-table, including a combination lock for each locker, can be built in red oak for fourteen dollars each, or in chestnut for twelve dollars each. The writer has used these tables for nearly two years and has found them satisfactory in every way.

*An Acid-proof Table Top:* PIERRE A. FISH, Laboratory of Comparative Physiology and Pharmacology, N. Y. State Veterinary College, Ithaca, N. Y.

Three or four years ago the writer saw in a pharmaceutical journal (*Merck's Report*) a formula for a black finish for table tops. The article did not give the author's name nor the original source of the formula, but stated that the method was 'used abroad.' Further acknowledgment can not, therefore, be made. The formula was as follows:

1.

| | |
|---|---|
| Copper sulphate | 1 part. |
| Potassium chlorate | 1 " |
| Water | 8 parts. |

Boiled until salts are dissolved.

2.

| | |
|---|---|
| Aniline hydrochlorate | 3 parts. |
| Water | 20 " |

Or if more readily procurable:

| | |
|---|---|
| Aniline | 6 " |
| Hydrochloric acid | 9 " |
| Water | 50 " |

By the use of a brush two coats of solution No. 1 are applied while hot, the second coat as soon as the first is dry; then two coats of solution No. 2, and the wood allowed to dry thoroughly. Later a coat of raw linseed oil is to be applied, using a cloth instead of a brush in order to get a thinner coat of the oil.

The writer used this method upon some old laboratory tables which had been finished in the usual way, the wood having been filled, oiled and varnished. After scraping off the finish down to the wood the solutions were applied, and the result was very satisfactory.

After some experimentation the formula was modified without materially affecting the cost and apparently increasing the resistance of the wood to the action of strong acids and alkalies. The modified formula follows:

1.

| | |
|---|---|
| Iron sulphate | 4 parts. |
| Copper sulphate | 4 " |
| Potassium permanganate | 8 " |
| Water | q. s. 100 " |

2.

| | | |
|---|---|---|
| Aniline | 12 | parts. |
| Hydrochloric acid | 18 | " |
| Water | q. s. 100 | " |
| or | | |
| Aniline hydrochlorate | 15 | " |
| Water | q. s. 100 | " |

Solution 2 has not been changed except to arrange the parts per hundred.

The method of application is the same except that after solution No. 1 has dried, the excess of the solution which has dried upon the surface of the wood is thoroughly rubbed off before the application of solution No. 2. The black color does not appear at once, but usually requires a few hours before becoming ebony black. The linseed oil may be diluted with turpentine without disadvantage, and after a few applications the surface will take on a dull and not displeasing polish. The table tops are easily cleaned by washing with water or suds after a course of work is completed, and the application of another coat of oil puts them in excellent order for another course of work.

Strong acids or alkalies when spilled, if soon wiped off, have scarcely a perceptible effect.

A slate or tile top is expensive not only in its original cost, but also as a destroyer of glassware. Wood tops when painted, oiled or paraffined, have objectionable features, the latter especially in warm weather. Old table tops, after the paint or oil is scraped off down to the wood, take the finish nearly as well as the new wood.

*A Useful Light for Biological Laboratories:* E. A. Andrews, Johns Hopkins University.

Experiments at the seashore and in this laboratory show that acetylene lamps have some advantages over other artificial lights for use with the microscope when good daylight is not available. These are: less irritating character of the light, greater whiteness, that enables color to be justly judged, and portability. With these is joined an intensity sufficient for use with Zeiss 18-ocular and 2-mm. objective.

The Welsbach light with Eisen's color screens* gives excellent results, but the aniline screens are troublesome, the mantles fragile and a gas supply not everywhere available.

The electric lamps as used by Metcalf† are exceedingly convenient, but less powerful and less white than the acetylene lamp.

Some of the better acetylene bicycle lamps give good results for the individual worker; but, till the market be supplied with a lamp specialized for our purposes, the best lamp for individual and for class use seems to be the acetylene lamp known as the 'Electrolite.' To adapt this to microscopic work we add a 'bobeche' as used for Welsbach lights, made of finely ground imported glass. There is also added an opaque shade, instead of a globe, large enough to restrict the light to the area of the table in use. All the light used passes through the ground glass and is diffused.

For use with high powers and vertical stand the too tall lamp may be placed lower than the work table. On the other hand, for a class using low powers the tall stand will spread the light, so that ten or twelve using Zeiss D and ocular 2 may work around one lamp if the tables are properly placed.

The objection to acetylene lamps is the trouble of attending to them, but in the 'Electrolite' filling and cleaning are not difficult, and with one charge of carbide the lamp may be put out and relighted at any time till more than ten hours of actual burning have passed. Acetylene for microscopic work has been commended

* *Zeit f. wiss. Mik.*, 1897.

† Science, 1901.

by the Canadian pathologist, Chas. H. Higgins.*

*A New Method of Embedding Small Objects:* GEORGE LEFEVRE, University of Missouri.

A special form of watch-glass was described which obviates the usual difficulties encountered in embedding loose, minute objects like echinoderm eggs.

The dish is a flat, solid watch-glass, containing a shallow concavity, in the bottom of which is molded a narrow, slot-like groove or trough.

The objects, after saturation with the solvent, are transferred to the dish, filled with melted paraffin and kept warm on the bath, by carefully dropping them from a pipette into the groove, where, owing to the confined space, they will remain closely massed. The bottom of the dish is then rapidly cooled on the surface of water, and the paraffin, when thoroughly hardened, may be removed without difficulty. The objects are held in the portion of the paraffin which previously filled the groove and which now projects from the surface of the block. The block is then attached to the paraffin-holder of the microtome, and the objects are ready for sectioning.

The practical usefulness of this dish has been thoroughly tested, and experience has shown that it may be manipulated so easily and conveniently that the embedding in it of such minute objects as it is intended for becomes as simple an operation as the embedding of larger ones which may be handled individually.

In addition to its use as described above, the dish is serviceable for the purpose of orientation. A small object lying in the groove may be rapidly oriented with a warm needle under the microscope and placed in any desired position. It is then possible to cool the paraffin without disturbing the object.

* *Acetylene Gas Journal*, 1901.

*The Heredity of Sex:* W. E. CASTLE, Harvard University. Presented by title. (Published in full in *Bulletin Mus. Comp. Zool., Harvard College.*)

1. Sex is an attribute of every egg and spermatozoon. It is independent of environment, and is inherited in accordance either with Mendel's law of heredity or with the principle of mosaic inheritance.

2. Mendel's law includes (*a*) the principle of *dominance* in the zygote of one of two alternative characters over the other, and (*b*) the principle of *segregation* of those characters at the formation of gametes.

3. In *mosaic* individuals alternative characters coexist without dominance of either; they pass together (*without segregation*) into the gametes.

4. Mendel's law governs the heredity of sex among dicœcious animals and plants; but hermaphroditic organisms are sex-mosaics, and form only mosaic gametes.

5. In dicœcious organisms, (*a*) one sex dominates, the other is latent; (*b*) each gamete bears the characters of one sex only, but can unite in fertilization only with a gamete bearing the characters of the *opposite* sex; (*c*) in the zygote sometimes the male character dominates, sometimes the female.

6. In parthenogenetic animals the female character invariably dominates over the male when both are present together. In such animals, (*a*) all fertilized eggs are female; (*b*) unfertilized eggs produced without segregation of sex-characters are female; (*c*) males develop only from unfertilized eggs *from which the female character has been eliminated.*

7. The female character eliminated from the male parthenogenetic egg passes into the testis; hence the spermatozoa of parthenogenetic animals are female (example, honey-bee).

8. Sex-characters segregate at the second (the 'reduction') maturation division. For eggs which develop without fertilization and without a second maturation division contain both the male and the female characters, the former recessive, the latter dominant. But, in normally parthenogenetic species, eggs which undergo a second maturation division and then develop without fertilization are always male. In such species the female character regularly passes from the egg into the second polar cell; in diœcious animals *either* sex-character may remain in the egg.

Gilman A. Drew,
*Secretary (Eastern Branch).*
University of Maine.

## SCIENTIFIC BOOKS.

*Die Biogenhypothese. Eine kritisch-experimentelle Studie über die Vorgänge in der lebendigen Substanz.* By Max Verworn. Jena, Gustav Fischer. 1903. 8vo. Pp. 114.

To consolidate the ideas which are presenting themselves more or less obtrusively to the minds of all workers in the biological sciences, and to give them concrete expression, is an accomplishment of no little importance, and it is this which Professor Verworn has attempted in propounding his Biogen-theory. Biogen is the special constituent of protoplasm whose decomposition and recomposition are the basis of the phenomena which we recognize as life, and the paper now under review is an examination into the nature of vital phenomena and an endeavor to deduce from this examination what the general composition and structure of the biogen molecules must be.

In its essence Verworn's theory differs but slightly from that advanced by Pflüger many years ago; it does differ, however, in its details. For it recognizes the similarity of the chemical processes taking place in the cell to those manifested during the action of an enzyme, accepting the prevalent view that an enzyme acts as a catalyzing agent and that the action of a catalyzer is the formation of a labile intermediate product which instantly decomposes, restoring the catalyzer to its original condition. Enzymes exist in the living substance which are capable of bringing about complicated syntheses and have the power of producing by their activity additional quantities of themselves; such phenomena demand the assumption that even in the molecules of the enzyme metabolism occurs and the biogen molecule may be regarded as something similar to such an enzyme.

Assuming this idea as a foundation, what may be predicated concerning the special composition of the biogen molecule? It is well known that an increase in the amount of oxygen increases, and a diminution of it diminishes, the irritability of the living substance, and Professor Verworn believes that it has been established by his own observations and those of his pupils on strychninized frogs that this phenomenon depends upon an increase in the lability of the biogen molecules in the presence of oxygen, and a diminution of it in the absence of that substance. If this be true, then it may be assumed that there is in the biogen molecule a chemical group which reacts readily with oxygen, and, since the functional activity of muscle, for instance, is associated, as Hermann demonstrated long ago, with the formation of non-nitrogenous products of decomposition, it may be supposed that the reacting group is a carbohydrate group, or, perhaps, on account of its affinity for oxygen, a carbon group of the type of a carbohydrate with a terminal aldehyde group.

But in addition there must also be a nitrogenous group in the molecule, since a continuous nitrogenous catabolism is going on in the tissues, and that this group is probably of the benzol type is shown by the formation of aromatic decomposition products, such as tyrosin, indol, phenol, skatol, etc., as the result of the digestion or putrefaction of albumen compounds. For the building up of a complicated organic compound a benzol group presents many possibilities, and Verworn supposes that such a group forms the center of a biogen molecule and that the carbohydrate

group is a side chain associated with it. Further, he supposes that the central group has attached to it another side chain which acts as the receiver and transmitter of the oxygen, and consists of a nitrogenous or iron compound, since certain compounds of either of these elements readily combine with oxygen and yield it up again. A biogen molecule may, then, be pictured as composed of an oxygen receptor and translator, consisting of a nitrogen or iron group, and oxidation material represented by a carbohydrate group with certain aldehyde-like peculiarities, both these groups being united as side chains to a benzol nucleus.

In such a molecule two varieties of destructive change may occur: what may be termed functional dissociation, affecting only the carbohydrate side chain, and destructive decomposition, which affects the entire molecule. The latter process necessarily impairs or destroys the activity of the molecule, and is compensated for by the synthetizing powers of the unaltered biogens which, acting on the products of digestion, build up additional molecules by a process of polymerization.

It is believed that there is no evidence of the existence of biogens in the cell nucleus, although this structure, directly or indirectly, contributes to the maintenance of the metabolism of the cytoplasm. The active molecules are located exclusively in the cytoplasm, which also contains reserve supplies of nutrition and of oxygen, the latter being in composition, and it is also supposed that there is present normally a greater or less amount of material, produced by the action of the cell enzymes, and of such a nature that it can at once be employed in the restitution of the biogen molecules.

Such is, in outline, the biogen theory, and having expounded it, Professor Verworn proceeds to apply it to the explanation of certain physiological phenomena. He points out that two changes may be recognized as causes in the diminishment of a response to stimuli: (1) A diminution or suppression of the lability of the molecules and (2) a diminution or suppression of the supply of restitution material. The characteristic symptom of the first of these causes is a gradual rise in strength of the minimal stimulus during the development of the phenomenon, while that of the second is the occurrence during its development of constantly increasing intervals during which the tissue fails to respond to the stimulus. On this basis a distinction, already drawn on somewhat similar lines by an American physiologist, is made between *fatigue* and *exhaustion,* the latter being regarded as due to the imperfect restitution of the molecules, while the former is the result of an impairment of their lability, owing to an accumulation in the tissues of catabolic substances which act as narcotics. For it is claimed that the effect of narcotics in general is an inhibition of the lability of the biogens.

It would carry us too far to follow the author into his application of the theory to the explanation of the phenomena of the self-regulation of metabolism, of rhythm and of the source of muscular energy. Suffice it to say that these subjects are treated with the same clearness and suggestiveness as distinguish the remainder of the paper. Professor Verworn is careful to insist that his theory claims merely the rank of a working hypothesis, and, viewed in this light, it should serve a purpose in stimulating further investigation. Its similarity to Pflüger's hypothesis has been already noted; indeed, it might be characterized as Pflüger's theory expressed with greater precision and combined with an idea borrowed from Ehrlich's well-known theory of immunity. One may question the advisability of substituting the single chemical compound biogen for the more complex protoplasm as the material basis of vital energy, and it may be claimed that the assumed structure of the biogen molecule is altogether too schematic; but, nevertheless, it will be admitted that the paper is full of interest and suggestion, and even though the future may show the theory to be futile, it must be remembered, as the author points out, that 'for the development of human intellectual life a fertile error has infinitely greater value than an unfertile fact.'

J. P. McM.

*Results of Observations with the Zenith Telescope of the Flower Astronomical Observatory*—from September 6, 1898, to August 30, 1901. By Charles L. Doolittle.

This is fourth in the series of publications by Professor Doolittle of observations of latitude. The first two contained observations from April 1, 1876, to August 19, 1895, made at the Sayre Observatory, Bethlehem, Pa.; and the last two, from October 1, 1896, to August 30, 1901, at the Flower Observatory of the University of Pennsylvania.

This series is of exceptional value as being the earliest, as well as the most prolonged, thus far made in the investigation of latitude variations. It was begun seven years before the first proposal by Fergola at the session of the International Geodetic Association in Rome, that there should be an observational test of the constancy of latitudes, and eight years before Küstner began his observations whereby the discovery of variation was first boldly announced as proved. From that beginning, the series has continued, though with some interruptions, until to-day. The charts accompanying these four publications therefore show nearly a continuous curve from December, 1889, to September, 1901. Sections earlier than 1889 may be platted from the data given. The precision of the observations is shown by a progressively diminishing probable error for a single determination of latitude ranging from ± 0″.578 at the start with an inferior 'second-hand' instrument, to ± 0″.134 at present, with a superior instrument of Warner & Swasey's construction.

Possessing fully as much interest as the latitude curve, are the seven values of the aberration constant, simultaneously deduced as a by-product from the same observations, viz.,

| | ″ | | |
|---|---|---|---|
| 1889, Dec. 1, to 1890, Dec 13..20.448 | ± | 0.014 | ½ |
| 1892, Oct. 10, to 1893, Dec. 27.20.551 | | .009 | 1 |
| 1894, Jan. 19, to 1895, Aug. 19.20.537 | | .014 | 1 |
| 1896, Oct. 1, to 1898, Aug. 16..20.580 | | .008 | ½ |
| 1898, Sept. 6, to 1899, Nov. 27..20.540 | | .010 | 1 |
| 1900, May 5, to 1901, Aug. 30..20.561 | | .008 | 1 |
| 1901, Oct. 1, to 1902, Aug. 18..20.510 | | | 1 |

The last value is a preliminary determination announced previous to publication of the observations on which it depends. The mean of these values is 20″.539, which differs only 0″.016 from the mean of all determinations thus far made by all methods included in Dr. Chandler's discussion of this value (*A. J.* 529, 530), namely 20″.523.

In view of the high degree of accuracy now attained in these observations and the prolonged period of time over which a single observer has already extended them, though beset with singular difficulties, particularly in the earlier portions of the series, it is a cause for gratification that this fourth publication does not mark the termination of Professor Doolittle's work. It is still in progress, and astronomers may confidently expect the publication of a fifth part, from August 30, 1901, onwards.

Herman S. Davis.

*A Treatise on Roads and Pavements.* By Ira Osborn Baker, C.E., Professor of Civil Engineering, University of Illinois, etc. First edition, first thousand. New York, John Wiley and Sons; London, Chapman and Hall, limited. 1903.

According to the preface, 'the object of this book is to give a discussion, from the point of view of the engineer, of the principles involved in the construction of country roads and city pavements.'

From this point of view we believe the work of the author extremely well done. We also believe that enough new matter and new ideas have been introduced fully to warrant this addition to the already large number of similar works devoted to this general subject.

Especially admirable is the arrangement of chapters and of articles under the chapters. This arrangement gives the table of contents unusual value, enabling the reader at a glance to observe both the presence and absence of the matter sought.

While almost every possible subject is present, we note with some surprise the absence of any detailed discussion of cements, although the use of cements in concretes and concrete foundations and for other minor

purposes in road-making is fully treated. We presume the chemistry and technology of cements have been fully treated in other works by the same author; but we think the omission in the present work of this subject has been a mistake, as many problems in road construction depend for their successful solution upon a thorough and discriminating knowledge of the nature and quality of the cements that are upon the market.

Another defect of the work of a more serious nature, arises from the attempt of an engineer to discuss problems that do not pertain to engineering. We refer to the entire discussion of the subjects embraced in Chapter XIII. This work is published in 1903, yet a careful examination of the entire chapter fails to disclose anything more recent than about two years, and most of it is ten years old. The chapter is evidently written up 'from the book,' instead of from actual experience and personal knowledge; hence the discussion proceeds without discrimination.

It is not to be expected that an author will discuss all subjects equally well; but it is to be regretted that in a work furnishing in other respects so much material of permanent value, this important subject of asphalt pavement should be discussed in such a manner as to be often misleading and generally of but little worth.

While the work will greatly aid the builders of city streets, we believe it will especially commend itself to that larger body of intelligent men who are at this time interested in the improvement of country roads, and to them we commend its careful perusal.

S. F. PECKHAM.

## SCIENTIFIC JOURNALS AND ARTICLES.

THE March number of the *Biological Bulletin*, Volume IV., No. 4, contains the following papers:

W. M. WHEELER and J. F. MCCLENDON: 'Dimorphic Queens in an American Ant (*Lasius latipes* Walsh).'

RALPH S. LILLIE: 'Fusion of Blastomeres and Nuclear Division without Cell-division in Solutions of Non-electrolytes.'

CHARLES T. BRUES: 'The Structure and Significance of Vestigial Wings among Insects.'

S. J. HOLMES: 'Death-Feigning in Terrestrial Amphipods.'

EDMUND B. WILSON: 'Notes on the Reversal of Asymmetry in the Regeneration of the Chelae in *Alpheus heterochelis*.'

FLORENCE PEEBLES: 'A Preliminary Note on the Position of the Primitive Streak, and its Relation to the Embryo of the Chick.'

THE principal contents of the *National Geographic Magazine* for March include 'The Canadian Boundary,' by John W. Foster, ex-Secretary of State (a review of the methods by which the line has been adjusted and marked); 'Mountains of Unimak Island, Alaska,' by Ferdinand Westdahl; 'Opening of the Alaskan Territory,' by Harrington Emerson; 'The Forests of Canada,' 'Work in the Far South,' 'The Development of Cuba,' 'Theories of Volcanic Action.' Geographic notes and literature.

## SOCIETIES AND ACADEMIES.

### GEOLOGICAL SOCIETY OF WASHINGTON.

AT the 139th meeting of the society, held in the assembly hall of the Cosmos Club, Wednesday evening, February 25, 1903, an important discussion on the 'Genetic Classification of Ore Deposits,' begun on January 14, was continued.

Mr. Emmons, in opening the discussion, remarked that the classification of ore deposits on a purely genetic basis had been proposed, not as a practical classification, or one that could at the present day be anything more than tentative, but mainly for the purpose of bringing out the theoretical views to which various workers had arrived as the result of their studies. It seemed, therefore, important to distinguish what was purely speculative from what had actually been demonstrated. Messrs. Weed and Spurr, who had opened the discussion, ascribed an importance to igneous agencies which probably would not be admitted by a large class of workers in the field, especially as applied to certain deposits given as types of one or the other of their classes. This application seemed based on speculation rather than on actual demonstration. The important question seemed to be the capability of igneous magmas to supply

the amount of water necessary for the formation of ore deposits as they are found in nature. Professor Kemp has been a strong advocate of the affirmative side of this question.

Professor J. F. Kemp, continuing the discussion, said: "In the establishment of types of ore deposits we should seek certainties as much as possible, and avoid cases which admit of difference in interpretation. If we use source and method of introduction of material as a fundamental principle, we shall do well in doubtful cases to fall back on points of geological structure, since, regarding the facts of the latter, there can seldom arise uncertainty. As well-established types we have at one extreme magmatic segregation from igneous magmas; at the other extreme, placers and residual concentrates produced by water. Starting now with contact deposits, produced especially by the action of eruptives on limestone and from pegmatites, which are assured after-births of vulcanism, we may proceed through the various types of ore bodies to an extreme produced by meteoric waters. Mr. Weed has done a valued service in emphasizing the igneous causes, and surely no one who appreciates the huge garnet zones and the amount of silica contributed to them by the eruptive, can fail to see in the eruptive itself a rich source of quartz for veins. When we appreciate further, as Mr. Lindgren has shown for the gold deposits of North America, that their formation was intense, relatively brief and local, and that it followed the outbreak of eruptions in each case, and that geological periods and even eras passed without vein formation, we must attribute great efficiency to the eruptive rock. The dryness of deep mines, now that it is realized, has greatly restricted our old ideas of the amount of meteoric ground-water. The tendency, therefore, to emphasize igneous agents is well justified, and is a distinct advance."

Mr. T. A. Rickard referred to the want of unanimity concerning the origin of ores, and stated it as his belief that no scheme of classification would be generally adopted while authoritative geologists remained so wide apart in their conclusions. He pointed out that the trend of opinion had favored igneous or aqueous agencies at different periods in the history of the subject, and that a gradual compromise of views seemed to be the inevitable outcome.

In Colorado it is a remarkable fact that the profitable mines are distributed through every geological terrain, from the Archean granite to a Tertiary conglomerate, and mining is going on in rocks belonging to all the principal subdivisions of geological time and amid a variety of petrographic environment which includes nearly all of the principal sedimentary and crystalline rocks. In arriving at the age of the country enclosing these lodes it has frequently been difficult to consider the sedimentary apart from the intrusive igneous rock and it is not too much to say that there is not a mining district, among the sixty-five which he has tabulated, in which igneous rocks do not occur in close association with the ore deposits.

Mr. F. L. Ransome, while not denying that pneumatolysis might be an effective factor in ore deposition, considered that the genetic classifications recently presented to the society carried this suggestive hypothesis further than facts warrant. He illustrated some of the objections to the extreme views of the igneous school of ore-deposition by reference to the occurrence of ores in the Mother Lode district of California, the San Juan and Rico districts in Colorado, and the Globe and Bisbee districts in Arizona. It was pointed out that the important ore-bodies of these districts were formed after the neighboring eruptive rocks had solidified, and that pneumatolysis, so far as known masses of igneous rock were concerned, was not directly active in ore-genesis. His own experience led him to regard the action of heated water, probably for the most part of meteoric origin, as the most generally effective agent in the formation of the greater number of ore-bodies, as we know them.

Professor C. R. Van Hise stated that in order to get a proper perspective for the appreciation of differences of view, it would be well first to give a summary of points of agreement. Attention was called by the speaker to the fact that, in his paper published

two years ago, upon 'Some Principles Controlling the Deposition of Ores,' it was stated that the metals of some ores are derived directly from adjacent igneous rocks; that the igneous rocks are the ultimate source of all the metals of ore deposits; that igneous rocks have an influence upon ore deposits by contributing metals and solutions to them, and a very important effect in heating solutions of meteoric origin.

As a basis for discussion the following provisional genetic classification was submitted:

Metallic Ore Deposits.
- (*A*) Sedimentary.
  - (*a*) Chemical precipitates.
  - (*b*) Mechanical concentrates.
    - (1) Residuary deposits.
    - (2) Stream deposits.
    - (3) Beach deposits.
- (*B*) Igneous. {Magmatic segregations.
- (*C*) Metamorphic.
  - (*a*) Ores deposited from gaseous solution.
  - (*b*) Ores deposited from aqueous solution.
    - (1) Ascending waters.
    - (2) Descending waters.
    - (3) Ascending and descending waters.

The classing of a large proportion of ores as pneumatolytic, fumarolic, solfataric and pneumato-hydato-genetic, in various recent publications, was deprecated. It was asked 'what are the criteria by which ore deposits are known to be deposited by gaseous solutions?' If this question can not be satisfactorily answered, what can be said as to the criteria upon which ores deposited by gaseous solutions are again subdivided? The placing of various ore deposits of many well-known districts in such classes as fumarolic solfataric, pneumatolytic, etc., without giving evidence for such a distribution, seemed to the speaker to be premature.

The criteria by which ores deposited by aqueous solutions may be discriminated were briefly summarized and the conclusion reached, from the application of these criteria, that this class of ore deposits is one of greater importance to men than any other class, and probably of greater importance than all other classes.

W. C. MENDENHALL,
*Secretary.*

## ENTOMOLOGICAL SOCIETY OF WASHINGTON.

THE 175th regular meeting was held on February 19, 1903, fourteen members present. Mr. William H. Ashmead was elected vice-president of the Washington Academy of Sciences for the Entomological Society.

Mr. Ashmead exhibited two species of wasps from Chile. The first, *Agenia xanthopus* Spinola, is remarkable because of the very short wings possessed by both sexes. This species is a synonym of *Pompilus gravesii* Haliday and will fall into the genus *Sphictostethus* of Kohl. The other species was *Cosila chilensis* Spinola, the type of Mr. Ashmead's family Cosilidæ.

Dr. Dyar presented the description of a new genus and species of Geometrid moths from Stockton, Utah, exhibiting specimens. He presented, further, a synoptic table for separating the North American white-marked species of *Eucosma,* a genus of moths belonging to the family Tortricidæ, with the description of a new species from Colorado. Dr. Dyar showed also a copy of Volume VII., Number 1, of *The Insect World,* the entomological magazine published in Japanese by Y. Nawa, which contains a colored plate of a moth and larva parasitic upon a leaf-hopper belonging to the homopterous family Fulgoridæ. He said that this was of special interest in connection with the species found by Messrs. Schwarz and Barber in New Mexico and which he had recently described before the society as a new species, *Epipyrops barberiana.* The moth figured by Mr. Nawa seems to be also an *Epipyrops.* It is not yet clearly known what is the food of these larvæ. Westwood supposed that they fed upon the white secretion of the Fulgorids, but Mr. Nawa, in his account of the Japanese species, stated that the larvæ secreted a white covering, and Dr. Dyar did not think it reasonable that the larvæ should secrete a substance sim-

ilar to their own food. As there was but little of this pruinose matter on the host, certainly not enough to support several larvæ, he inclined to the opinion that the *Epipyrops* larvæ might prove to be true parasites.

Mr. Simpson showed a micro-photograph of sections of the eversible gland of the Io moth larva (*Automeris io* Fabricius). He stated that, in exceptional specimens, this gland was missing.

A paper by Mr. August Busck, 'Notes on Brackenridge Clemens's Types of Tineina,' was presented. It consisted of detailed studies of Dr. Clemens's types of Microlepidoptera in the Academy of Natural Sciences of Philadelphia, resulting in the identification of all but eight of his 200 species. Of these eight, five have been identified with certainty from the descriptions.

Mr. Ashmead spoke on 'Some Remarkable New Genera in Cynipoidea,' exhibiting specimens of nine new genera of gall-wasps from Brazil and California, and commenting upon their peculiarities.

Dr. Dyar presented the first part of a 'List of Lepidoptera taken at Williams, Arizona, by Messrs. Schwarz and Barber.' The list included 139 species, fifteen of which were described as new.

A paper by Mr. A. N. Caudell, 'Notes on the Nomenclature of Blattidæ' (cockroaches), dealt with the question of determining the type species of the Linnæan genus *Blatta*. The author showed that Latreille, before any of the old species had been removed from the genus, designated *Blatta orientalis* as the type. He proposed a new generic name for the 'croton bug,' *Phyllodromia* being preoccupied in the Diptera.

The three following papers were read by title: 'Neuropteroid Insects from Arizona,' by Nathan Banks; 'The Genera of the Dipterous Family Empididæ, with Notes and New Species,' by D. W. Coquillett; 'Myrmeleonidæ from Arizona,' by Rolla P. Currie.

Rolla P. Currie,
*Recording Secretary.*

## New York Academy of Sciences.
### Section of Biology.

At the February meeting papers by Dr. W. A. Cannon, Professor Bashford Dean and Professor H. F. Osborn were presented.

Dr. Cannon's paper, 'Cytological Studies of Variation in Hybrids,' was based upon his studies of hybrids of cotton plants, and discussed the relation between the maturation mitoses in hybrids and the variation of the hybrid race. Two forms of mitosis occur in fertile hybrids. One of these is the normal type, which occurs in pure races and may be supposed to give rise to reproductive cells of pure descent. This is the form in hybrids between closely related parents (monohybrids), and probably forms the basis for the regular reversion in them. The other type of mitosis is irregular. It is suggested that this kind of maturation mitosis may organize cells of mixed descent, and if found in hybrids from parents rather distantly related, would constitute the basis for such mixture of the characters of the pure parents as occurs in these hybrids. However, after the characters have become mixed in all possible proportions, and the limit of variation thus reached, normal mitoses probably occur. Thus it appears that the mingling of the characters, as well as the regular reversion in hybrids, may have a morphological basis.

Professor Dean, in a paper entitled 'Past and Present Study of Zoology in Japan,' first reviewed the history of the study of zoology, and then considered the present status of zoological investigation and teaching in that country. With the aid of lantern illustration, descriptions were given of the laboratories, the fauna available for study, and the prominent Japanese workers.

Professor Osborn's paper, 'On the Primary Divisions of the Reptilia into Two Subclasses,' was presented by Dr. Hay. This has been published in full in Science for February 13, 1903.

The third meeting of the year was held at the American Museum of Natural History on March 9, Professor Bashford Dean presiding. The following papers were presented:

Mr. W. S. Sutton, in a paper on 'Chromosomic Reduction in its Relation to Mendel's Law,' pointed out that the processes of synapsis and reduction in the germ-cells of the grasshopper, *Brachystola,* are such as to indicate strongly that they are the causes of the character-reduction which forms the basis of the Mendelian principle of heredity. Probably the reducing division in *Brachystola* does not effect a separation of chromosomes into maternal and paternal groups, but the chromosome-series of the mature germ-cells is made up of a chance combination of chromosomes from the two parents. This is in accord with the results of Mendel and others who have shown that hybrid offspring exhibit a chance combination of characters from the two parental lines.

Professor Graham Lusk discussed the 'Influence of Nutrition on the Growth of Young Mammals,' basing this paper upon experiments conducted in his laboratory by Dr. Margaret B. Wilson (*Amer. Jour. Phy.*, VIII., 197, 1902), whose results support his own earlier work. It was shown that new-born pigs develop normally when fed with skimmed cow's milk, or with the same milk to which three per cent. of dextrose or lactose has been added. The growth is proportional to the calorific value of the food—always supposing sufficient proteid to be present. This agrees with the results of other workers who have studied the growth of children and other young mammals. The growth of the pigs was on the average about 215 grams growth for 1,000 calories in the food. Eighteen to nineteen per cent. of the energy of the food was retained in the body as new tissue.

The third paper, 'On the Colors and Color-Patterns of Certain Bermuda Fishes,' by Professor C. L. Bristol, dealt with correlations between habits and appearance with reference to warning and protective coloration of these fishes. An abstract will soon appear in SCIENCE in the proceedings of the American Morphological Society. M. A. BIGELOW,

*Secretary.*

## KANSAS ACADEMY OF SCIENCE.

THE 35th annual meeting of the Kansas Academy of Science was held in the Museum room of the academy at Topeka, December 31, 1902, and January 1 and 2, 1903. There was a large attendance of members and twenty-five new members were elected. The reports of the officers for the past year showed that the academy was in a prosperous condition. New and comfortable quarters have been recently given to the academy by the state.

These rooms are in the Capitol building at Topeka and include office and museum rooms, well furnished. At the sessions of the academy forty-three papers were presented on biological, chemical, geological and physical subjects. Most of these papers will appear in the eighteenth volume of the academy *Transactions,* now in press.

Among the papers presented, the following might perhaps be noted as of general interest: 'The Flora of Kansas,' by B. B. Smyth and J. H. Schaffner; 'Further Notes on Loco Weed,' by L. E. Sayre; 'Food Habits of California Sea Lions,' by L. L. Dyche; 'Ionic Velocities in Liquid Ammonia Solutions,' by E. C. Franklin; 'Crystalline Liquids,' by Fred S. Porter; 'Examination of Some Kansas Petroleum,' by Edw. Bartow and E. V. McCollum; 'The Extent and Thickness of the Oklahoma Gypsum,' by C. N. Gould; 'On the Alkyl Sulphates,' by F. W. Bushong; 'The New Washburn College Telescope,' by H. I. Woods; 'Experiences with Early Man,' by Chas. H. Sternberg.

A number of valuable papers on Kansas entomology were presented by two Kansas authorities, Warren Knaus and Dr. F. H. Snow. The disputed subject of gold in Kansas was discussed in a paper by Professor J. T. Lovewell. The public address was given by the retiring president, J. T. Willard, on the subject, 'The Mission and Limitations of Science.'

The following were elected officers for 1903:

*President*—J. C. Cooper, Topeka.

*Vice-Presidents*—Edward Bartow, Lawrence, and J. A. Yates, Ottawa.

*Treasurer*—Alva J. Smith, Emporia.

*Secretary*—G. P. Grimsley, Topeka.

The next meeting of the academy will be held near the close of 1903 at Manhattan.

It was decided to revise and enlarge the exchange list of the academy *Transactions*.

G. P. GRIMSLEY,
*Secretary*.

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## DISCUSSION AND CORRESPONDENCE.

### THE ACTIVITY OF MONT PELÉE.

THE generally friendly tone of your reviewer's (T. A. J., Jr.) notice of my 'Mont Pelée and the Tragedy of Martinique' makes it almost ungenerous on my part to take exception to any of the statements that this notice contains. There is one point, however, dealing directly with the physics of Mont Pelée, that seems to me to deserve attention from its bearing upon volcanic phenomena generally. Your reviewer takes strong exception to the use that I have made of Russell's formula in computing the cubical content of the ash-cloud, and remarks that the defect in my reasoning 'lies in the assumption that a primary eruption is continuous for days or even hours.' The somewhat surprising statement follows that: "Professor Heilprin has failed to discriminate primary and secondary eruptions when he talks of Mt. Pelée 'being in a condition of forceful activity for upwards of 200 days.'" This does scant justice to my powers of observation, for it takes no scientist to separate or discriminate between the two classes of phenomena, any more than it requires a scientific eye to note the difference between the explosion of a dripping drop from a 'boiling kettle' and the 'blow' that issues from the snout. I fear that Dr. Jaggar has not seen Pelée in 'Pelée's glory,' otherwise he could hardly have hazarded the statement to which attention is called, and still less the subsequent one that 'the reviewer questions whether the volcano has been forcefully active from great depths for that many [200] minutes.' Had Mr. Jaggar been on the island of Martinique at any time during the days August 25 to September 3, inclusive, his conception of a 'primary eruption' would be very different from what it manifestly now is—he would have seen a raging central eruption continuous for that time, and not a landscape of 'tremendous puffs that rise many thousand feet.'

When I prepared the chapter of my book which contains the calculations to which my reviewer takes exception, I was unaware of the conditions of the volcano which followed after my leaving the island. These are in many ways most interesting, and tend to confirm my conclusions as to the extraordinary quantity of the sedimental discharge from Pelée. The continuous activity of the volcano has been such that in the interval between the first week in September and the middle of December the mountain had increased its height by nearly or quite 900 feet (!), the needled summit of the cone (which had united with the old crateral wall) being on December 16, as measured by Lacroix, 4,995 feet above sea-level. Much of this has since been destroyed, but Pelée is still at its work, adding to the 300 feet of ash that it has already laid down in parts of the valley of the Rivière Blanche. I do not think that the volcano can be seriously accused of working in working times of 'five or ten minutes.' In the days of the August-September activity, I feel satisfied—although necessarily lacking the means of *proving* the accuracy of my belief—that the continuous ash-discharge could not have been less than twenty per cent. of the measure of the steam-cloud; it may have been very much more.

ANGELO HEILPRIN.

PHILADELPHIA, PA.,
March 17, 1903.

### THE PUBLICATION OF REJECTED NAMES.

I AM glad to see Mr. Bather's letter, although I can not altogether agree with what he says. My view is that if a description appears, accompanied by two or more names in the same publication, all being simultaneous in point of time, nothing but 'priority of place' can furnish a certain and invariable rule for selecting the one to be retained. I do not want to disturb existing rules, but I do want to see the same rules in use for all groups of animals and plants. My objection to the action of Messrs. Banks and Knowlton was based on the fact that they seemed to me

to err against the most generally accepted rule covering the particular matter discussed; and even if I grant, for the sake of argument, that this opinion was wrong, it still remains true that they unnecessarily created difficulties and left opportunities for an annoying divergence of opinion.*

Systematists might 'be much happier' for the time being if left to go their own ways, but the trouble would merely be thrown with increased force on the shoulders of those coming after. Dr. D. S. Jordan, when recently replying in SCIENCE to a criticism of mine, indicated the desirability of letting each case stand on the basis of the original publication, and not leaving the types of genera or species to be determined by the process of subsequent elimination. Now as a matter of plain common sense this is surely much to be commended, but if I adopt Dr. Jordan's view (as I should much prefer to do), what am I to do about the innumerable names of genera (especially among the Lepidoptera) which have been determined by the 'elimination process'? It is surely excusable to wish to be consistent.

Zoologists seem to be agreeing to the eminently sensible view that homonyms must be exactly alike, not merely similar. Botanists, however, have made and are making many changes on account of mere similarity in names. For example, *Batschia carolinensis* Gmelin, 1791, is a *Lithospermum*, and the name of the species is suppressed (being changed to *gmelini*) because of *Lithospermum carolinianum* Lamarck, which is an *Onosmodium*. According to my view the first mentioned plant should be *Lithospermum carolinensis* (Gmel.). Many names of genera, even in zoology, are changed for such reasons, and as the matter can not be yet said to be settled, I think it is worth while to make as strong a stand as possible for the rule 'no homonymy without absolute identity of names.'

Zoologists generally agree that when subgenera or sections are raised to the rank of genera, the subgeneric or section names must be retained for the genera. Botanists, however, have frequently denied this altogether.

All these divergent practices are productive of future difficulties, and I can not see that anything is gained by going ahead with our eyes shut. Uniformity has to come, sooner or later.

T. D. A. COCKERELL.

* According to the plan indicated by Mr. Bather for saving the name *Cucumites lesquereuxii*, most published species would be nameless, as the name rarely occurs *after* the description! I should like to know what Mr. Bather thinks about the substitution of *Washingtonia* Raf., for *Osmorrhiza* Raf. as now adopted by American botanists.

### A RARE SCIENTIFIC BOOK.

TO THE EDITOR OF SCIENCE: I would like information concerning the following very rare scientific book:

Purkenje: 'Commentatio de examine physiologico organi visus et systematis cutanei. Vratislav' (Breslau), 1823. Francis Galton states in 'Finger Prints' ('92), that there is *one copy in America*. As I am desirous of locating this or any other American copy, I shall be grateful to any one who can give me information on the subject.

HARRIS HAWTHORNE WILDER.

SMITH COLLEGE,
March 6, 1903.

## *SHORTER ARTICLES.*

### ORIGIN OF THE WORD 'BAROMETER.'

THE instrument familiar to us all as the barometer was first universally known by the name of its inventor as 'Torricelli's tube'; de Guericke, the inventor of the air-pump, called his huge water-barometer 'Semper Vivum,' also 'Weather Mannikin,' with the Latin form 'Anemoscopium.'

Soon after the year 1665 the words 'baroscope' and 'barometer' came into general use in England, but the individual to whom the credit belongs for originating these terms has not been certainly known; the assertion made by a contributor to the *Edinburgh Review* for 1812 that 'baroscope' was first used by Professor George Sinclair, of Scotland, in 1668, is an error, for both words occur in the *Philosophical Transactions* four years earlier. The passage is unsigned and reads thus:

"Modern Philosophers, to avoid Circumlocutions call that Instrument, wherein a Cylinder of Quicksilver, of between 28 and 31 inches in Altitude, is kept suspended after the manner of the Torricellian Experiment, a Barometer or Baroscope, first made publick by that Noble Searcher of Nature, Mr. Boyle, and imployed by him and others to detect all the minut variations in the Pressure and Weight of the Air."

The mention of the words in connection with the name of Robert Boyle has led me to make a close examination of his voluminous and prolix writings. In Boyle's first publication, 'New Experiments Physico-Mechanical touching the Spring and Weight of the Air,' dated 1660, the words baroscope and barometer do not occur; he uses the common term 'tube,' and often writes of the 'mercurial cylinder.' Nor are these words used by him in his 'Defense of the Doctrine touching the Spring and the Weight of the Air * * * against the objections of Franciscus Linus,' a paper published in 1662.

Their use by the anonymous writer to the *Philosophical Transactions* in 1665 has been shown, and the question arises, who was this person who modestly concealed his name? I believe it was Boyle himself. This eminent man, who was so devoid of personal ambition that he declined a peerage, had a habit of writing about himself and his scientific labors in the third person, and often spoke of himself by fanciful, fictitious names, such as 'Philaretus' (in his fragmentary autobiography) and 'Carneades' (in the 'Sceptical Chymist'). That he should send an unsigned communication to a journal was not surprising, particularly as he had occasion to mention himself.

Be this as it may, my claim that Boyle originated the word barometer does not rest on such slender conjectures as these. One year later than the communication in the *Philosophical Transactions,* Boyle wrote to this journal (dated April 2, 1666) and said, 'barometrical observations (as for brevity's sake I call them),' using the personal pronoun this time. Elsewhere in the same paper are found the terms barometer, baroscope and baroscopical observations.

In his 'Continuation of New Experiments Physico-Mechanical * * * ' of which the preface is dated 1667, occurs the following phrase: 'But though about the barometer (as others have by their imitation allowed me to call the instrument mentioned).' (Boyle's Works, Birch's edition, Vol. III., p. 219, London, 1744.)

This sentence is virtually an admission by Boyle that he had coined the word, since others imitating him had allowed and encouraged him to use the term to designate the tube of Torricelli.

I conclude, therefore, that the word 'barometer' was introduced into our language by the English philosopher, the Hon. Robert Boyle, about the year 1665. Boyle, by the way, was a scholar, and able to use Greek in forming an English word. Finally, I may add that examination of Murray's Skeats' and other standard English dictionaries throws no light on the origin of the word; they merely refer to the *Philosophical Transactions* and give its obvious etymology.

Henry Carrington Bolton.

## The Response of the Hearts of Certain Molluscs, Decapods and Tunicates to Electrical Stimulation. (Preliminary Communication.)*

The physiology of cardiac muscle of the vertebrates is commonly regarded as differing from that of the skeletal muscle, besides the difference in rhythm, chiefly in these three points, namely, that cardiac muscle can not be tetanized, that a minimal stimulus is at the same time maximal (the 'all or nothing law'), and that, beginning with the systole, the muscle is in a condition of inexcitability, the excitability returning gradually during diastole. While making some observations on the comparative physiology of muscle in certain genera of marine molluscs at the Hopkins Seaside Laboratory in the summer of 1902, the ventricle of the systemic heart of

* From the Hopkins Seaside Laboratory and the Physiological Laboratory of Leland Stanford Jr. University.

*Loligo pealii* attracted my special attention, because its reactions to electrical stimulation did not seem to fall in line with the peculiarities of cardiac muscle just referred to. The *Loligo* ventricle responded to the interrupted current of sufficient intensity with a continuous, to all appearance, tetanic contraction, minimal stimuli were by no means at the same time maximal; and a refractory period or a state of inexcitability seemed not to be present.

This led to the examination of the hearts of the following invertebrates on these three points:

Tunicata:
*Clavelina* sp.
Mollusca:
*Octopus punctatus.*
*Loligo pealii.*
*Ariolimax columbianus.*
*Limax maximus.*
*Pleurobranchæa* sp.
*Doris* sp.
*Janus* sp.
*Æolus* sp.
*Haliotis craceropodii.*
*Haliotis rufescens.*
*Lucapina crenulata.*
*Cryptochiton stelleri.*
*Mytilus californianus.*
*Mya arenaria.*
Arthropoda:
*Cancer antennarius.*
*Brachynotus nudis.*
*Pachygrapsus crassipes.*
*Epialtus productus.*

Owing to the delicate structure of the ventricles of *Clavelina* and the nudibranchs (with the exception of a species of *Doris*) their contractions could not be recorded by the ordinary graphic method, but direct observation had to suffice. The ventricles of all the other species worked on were suspended and their reactions recorded by a light lever. But experiments were also performed on the ventricles *in situ,* as check on the graphic record.

1. In all the forms experimented on an intensity of the interrupted current was found to which the ventricles responded with a continuous maximal or supermaximal (as compared to the normal) contraction during its application. By varying the intensity and the rapidity of succession of the shocks superposition and partial fusion of the individual contractions were obtained (except in *Cryptochiton* and in some of the nudibranchs) similar to those of the skeletal muscle of vertebrates. The continuous contraction appeared to be truly 'tetanic' in character, except in case of *Cryptochiton* and some of the gastropods. The intensity of the interrupted current required to call forth the continuous contraction was considerably greater than sufficed to tetanize the body muscles in the same animal.

2. If by the refractory period is meant a state of inexcitability, I have so far been unable to demonstrate its presence in the ventricles of this series, for an intensity of the stimulus can in every case be found sufficient to affect the hearts in any phase of rhythmic contraction; but a period of reduced excitability, maximal during the systole, seems to be present in the case of the decapods, the cephalopods and in several of the gastropods.

3. Nor does the 'all or nothing law' apply to the hearts of this series of invertebrates. But as regards this relation of the magnitude of contraction to the intensity of the stimulus, there is a great difference between the ventricle of *Cryptochiton* on the one hand and that of *Octopus* or *Cancer* on the other. The *Octopus* ventricles seem to come nearest to the vertebrate heart on this point, while the ventricle of *Cryptochiton* in no wise appears to partake of this property of vertebrate cardiac muscle. With the exception of *Cryptochiton* and *Doris* the hearts give uniform beats to stimuli of considerable range in intensity, but increase in the intensity above this range is followed by increase in the height of contraction. In *Octopus* increase in the intensity of the stimulus above a certain strength seems to decrease the magnitude of contraction.

4. If the interrupted current is too weak to produce acceleration of the beats or the continuous contraction, it produces *inhibition in diastole* during its application to the ven-

tricles of *Mytilus, Mya, Haliotis, Lucapina, Limax, Ariolimax, Octopus,* and the decapods examined, very much like the vagus inhibition in vertebrates. In *Ariolimax* and *Mya* the inhibitory effect of single induced make or break shocks is readily demonstrated. If the application of a weak, interrupted current is long continued the ventricle will generally 'escape' from the inhibition during the stimulation. Cessation of the stimulation is generally followed by acceleration in the rate and increase in the magnitude of the beats.

5. The direct current produces make beats, make and break beats, total diastolic inhibition, partial inhibition of beats, acceleration of beats, and increase in 'tone' or a continuous 'tetanic' contraction, according to its intensity and direction, *i. e.*, whether the anode or the cathode is on the auricular end of the ventricles. In *Ariolimax* this difference in the ventricular response, according as the anode or the cathode is on the auricular end, is very manifest even with single induced shocks.

An account of previous investigations touching this subject is deferred to the more complete statement which will accompany the publication of the tracings.

A. J. Carlson.

Stanford University,
January 25, 1903.

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## *CURRENT NOTES ON PHYSIOGRAPHY.*

### SOUTHERN APPALACHIAN FOREST RESERVE.

'Senate Document 84' is a volume of 210 pages, 75 plates and 3 maps with the following title: 'Message from the President of the United States, transmitting a report of the Secretary of Agriculture in relation to the forests, rivers and mountains of the Southern Appalachian region' (Washington, 1902). 'Southern Appalachian Region' is the page heading throughout. The volume, whatever its name may be, is worth owning, as it presents an unusually well-illustrated account of 'the greatest physiographic feature in the eastern half of the continent,' with special reference to the creation by Congress of a national forest reserve, for conservation of the forest by use, rather than a national park, for conservation without use, as the Secretary of Agriculture puts it (p. 167). Chapters on topography and geology by Keith, hydrography by Pressey and Myers, and climate by Henry give concise accounts of these topics. Many of the plates are excellent. The text and the explanatory titles of some of the plates give, to our reading, too much importance to forest clearing as a cause of destructive floods. There seems exaggeration also in the statement under a fine view of Stone mountain, near Atlanta, Ga. (Pl. XIX.), that 'the ax and fire have removed the forest, and the heavy rains have removed the soil which once covered the larger part of this rocky knob.' It is estimated that not less than 10 per cent. of the region has a slope of less than ten degrees, while 24 per cent. of the region has been cleared. The hill- and mountain-side fields lose their surface soil in five or ten years, and must then be abandoned for new clearings. Native grasses do not suffice to hold the hillside soils, which are therefore often deeply gullied by rain wash. It is evidently out of the question to adopt the practice of terracing the hillsides, as is done by the crowded population of eastern Asia (see a good illustration in *Geogr. Journ.*, XXI., 1903, p. 116).

The Blue ridge, an important physiographic element of the region, is variously described in different parts of the volume; on one page it is 'a fairly well-defined mountain *range*'; on another, its northern part 'consists of ancient *plateaus*,' while upon 'the southern part of the *chain* * * * are situated a few individual peaks and ridges of commanding height'; again, it is a 'steep and well-defined *escarpment*,' and it fronts the Piedmont plateau 'like a *rampart*.' The italics are here introduced to emphasize the versatility of this remarkable *ridge*.

### SOUTHERN PATAGONIA.

Reference has already been made in these notes to Hatcher's exploration in Patagonia. Fuller description of his geographical results has now been published ('Reports of the Princeton University Expeditions to Pata-

gonia, 1896–1899,' Vol. I., 'Narrative of the Expeditions, Geography of Southern Patagonia,' by J. B. Hatcher, Princeton, 1903, 4to, xvi + 314 pp., map and numerous plates). The narrative abounds with interesting details of three journeys. The general account of the geography, in chapters headed plains, mountains, rivers, lakes, coast, climate, and Indian tribes, is most readable and instructive, although rather brief on certain topics where additional details would be welcome. The curious relation of the large piedmont lakes, east of the mountains, to the gorges by which they are drained through the main chain of the Andes, is properly characterized as unique; too little consideration seems to be given to glacial erosion in connection with these lakes. The great transverse valleys by which the plains are broken are, for the most part, followed by small or intermittent rivers; the valleys are shown to have been eroded before the submergence of the region, during the recovery from which the great shingle formation was spread over the plains as a littoral marine deposit. The terraces in the plains are ancient sea cliffs, cut during pauses in emergence, the cliff along the present coast being the last member of the series. Morainic deposits are abundant over the western plains, and extensive lava flows are spread over the central part of the plains; some of the flows are older than the great valleys, some are younger. In one case a river that once followed a valley to the Bay of San Julian was turned southward from its course by a lava flow, so that it now reaches the sea by Rio Chico de Santa Cruz, leaving its former valley dry. The southernmost of the transverse valleys, not yet entirely emerged, forms the Straits of Magellan. The chapter on the Tehuelche tribe gives many examples of the immediate dependence of these savages on their surroundings; they have curiously enough abandoned the use of bows and arrows, remains of which are found in their old camping grounds; since the introduction of horses by the Spaniards, the bolas are the chief weapon of the Indians.

### CAPTURED VALLEYS IN THE HIMALAYAS.

FRESHFIELD, Garwood and Sella made a tour around the highest mountain in the world during the autumn of 1899, and some account of their results have lately appeared. The leader of the party gives a narrative of the trip, with a superb panorama by Sella, in an article on 'The Glaciers of Kangchenjunga' (*Geogr. Journ.*, XIX., 1902, 453–472); and Garwood follows with some "Notes on a Map of 'the Glaciers of Kangchenjunga' with remarks on some of the physiographic features of the district" (*ibid.*, XX., 1902, 13–24). From the latter article we learn that the mountain slopes in the forested belt, up to about 10,000 feet, have 'a marked convex curve produced by the thick growth of vegetation,' instead of the typical concave basal curve; that the glaciers of the district formerly extended at least several miles beyond their present ends; that lakes are rare and small; that the 'entire absence of rock basins from valleys formerly filled by ice is not without bearing on the supposed origin of lakes by glacial erosion in other alpine districts'; and that hanging valleys were observed on several occasions in greater or less distinctness.

Two conspicuous examples of the last-named features are illustrated. They are explained as the high-level valley-heads of a former east-flowing consequent river system, now captured by a deep-lying, south-flowing subsequent stream. The excessive deepening of the subsequent valley beneath its hanging laterals is referred to two causes: (1) A hypothetical elevation of the central mountain mass due to the melting off of former supposedly heavy glaciers during an assumed interglacial period or periods, as a result of which the centrifugal south-flowing subsequent stream would deepen its valley, while the streams flowing 'east and west would be merely tilted sideways, and would tend to widen rather than deepen their valleys'; (2) a postulated protection of the hanging valleys by local glaciers, which 'would linger longer in the high-level hanging valleys than in the deeper valleys below.'

Whether the deep subsequent valley was

once occupied by a glacier is not stated; but the hanging valleys join it only three or four miles from the end of a large existing glacier that is fed from the great snow reservoirs of Kabru peak (24,015 feet). Hence Garwood's explanation of these hanging valleys, involving so many hypothetical conditions—even the capture of the headwaters of the assumed east-flowing consequent being hypothetical in a region of so complicated structure and of so much dissection since the capture is supposed to have taken place—can not at present be advisedly accepted in place of the much more probable explanation by glacial erosion. The suggested explanation becomes all the less satisfactory when it is perceived to depend on two very doubtful postulates: (1) the discordant relation of trunk and branch valleys is assumed to result in part from a supposed tilting of the drainage basin, yet no proof of the principle underlying this assumption is adduced from demonstrably tilted basins in non-glaciated regions; (2) the hanging valleys are supposed to have been occupied by glaciers that maintained a highly specialized and persistent relation to the valley mouths; yet no examples are adduced to show that this relation prevails in any region of existing glaciers.

One more point; Garwood argues for the 'superior erosive power of water over ice,' and this implies a misapprehension. It is not essential to the glacial origin of hanging valleys that the *erosive power of ice should be superior to that of water,* but only that the *erosive work of ice should be unlike that of water.* How long a time the main glaciers of a mountain range may have taken to scour out their over-deepened main channels and to leave the channels of smaller side glaciers in the form of hanging valleys, and what amount of work might have been accomplished by rivers in the same time and place, no one yet knows.

W. M. Davis.

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## *BOTANICAL NOTES.*

### TWO MORE BOTANICAL TEXT-BOOKS.

Within a couple of months two books for beginners in botany have been offered to the high schools of the country. The first is the 'Introduction to Botany' prepared by Professor Stevens, of the University of Kansas, and brought out by Heath & Company. It is an attempt to introduce the beginner to all departments of the science. Accordingly, he is directed in his studies of seeds, seedlings, roots, buds, stems, leaves, growth, movement, modified parts, flowers, seed dispersal, selected spermatophytes (twenty-five kinds), slime moulds, bacteria, yeasts, algæ, fungi, lichens, mosses, ferns, horsetails, adaptation to environment, plants of different regions, plants of past ages and classification. In all of these topics the subject is treated comprehensively. There is something of structure, morphology, physiology, ecology, as well as of the philosophy of botany. Throughout the chapters are scattered nearly two hundred observations and experiments to which the pupil's attention is directed. Part II. of the book describes the school herbarium, laboratory equipment, reagents and processes, and Part III. is devoted to a pretty complete but not very satisfactory glossary. A short 'flora' is appended to the volume, in which selected spermatophytes are briefly described. The treatment here is quite conservative, the old nomenclature being strictly followed, although the sequences of families are those of Engler.

The book contains a great deal of valuable matter, but it is open to the pedagogical criticism of not separating the elementary and fundamental from the advanced and more technical aspects of the science. In the hands of a wise and well-trained teacher it will be a helpful book, but in too many cases its use will leave the pupil in a more or less dazed and confused state of mind, on account of the fact that too many things have been brought to his notice in the short time allotted to the study. The author should prepare another book in which only the elementary and fundamental parts of the subject are presented to the beginner, and then the present work might be enlarged and elaborated for the use of advanced students.

The second book, with the suggestive title 'Botany all the Year Round,' is from the hand of E. F. Andrews, of the High School

of Washington, Georgia, and bears the imprint of the American Book Company. As stated by the author, the book 'aims to lead the pupil to Nature for the objects of each lesson, and to provide that the proper material shall always be available by so arranging the lessons that each subject will be taken up at just the time of the year when the material for it is most abundant.' The book thus assumes that the work is to begin in September, and continue the whole year, which is quite right. The pupil first takes up the leaf and its uses, in which such subjects as transpiration, respiration, the parts of the leaf, leaf arrangement, leaf adjustment and transformation of leaves are studied. He next studies fruits, under the topics, fleshy, dry, dehiscent and aggregate fruits, and this is followed by studies of seeds and seedlings, where he learns about monocotyledons and dicotyledons, the forms, growth and germination of seeds, etc. In like manner he studies roots, and underground stems, the proper stem, buds, branches and flowers. All of this takes 236 of the 300 pages of the book. Then we have a short chapter (14 pages) on ecology, followed by 36 pages devoted to the lower plants. The appendix contains a most useful list of books for reference, and the index appears to be satisfactory. While it emphasizes too much the higher forms of plants at the expense of the lower, reminding us at once of the old Gray's 'Lessons in Botany,' which it is evidently intended to replace in the southern states, it is perhaps as advanced a book as can be used successfully in the region for which it was written. The compound microscope is evidently a thing almost undreamed of in the schools for which it is intended, and so there is nothing else to be done but to send the youngsters into the fields for their laboratory work. Like the preceding book, this one attempts too much, but the fault is not quite so great here as there.

All in all, the two books are creditable additions to the already long list of American textbooks of botany. When they have been tried by some years of practical use in the schools they can be so revised as to improve them along the lines suggested above. In the meantime they will be helpful to many teachers in the secondary schools of the country.

### PLANT PATHOLOGY IN THE COLLEGES.

IN the 'Proceedings' of the Sixteenth Annual Convention of the Association of Agricultural Colleges and Experiment Stations, held at Atlanta, Ga., October 7–9, 1902, Professor Wilcox, of Alabama, makes some lively criticisms of botanical teaching in the colleges and universities of the country. His remarks are of course mainly directed towards the agricultural colleges, but they apply with equal force to the larger institutions. In but few of the colleges is there any attempt to teach plant physiology, and where it is entered as one of the botanical courses Professor Wilcox shows that it is often not physiology at all that is given. Pathology as a subject for the study of the college student is almost unknown even in the agricultural colleges. He says "the situation respecting the teaching of plant pathology is even more serious and non-effective than that of physiology. Substitution of an entirely different subject from real pathology seems to be the rule rather than the exception in the teaching of this subject." The difficulty which faces the Bureau of Plant Industry in the United States Department of Agriculture every time an additional plant pathologist is wanted is an indication of the truth of the charge brought against the colleges by Professor Wilcox.

### A DISEASE OF THE WHITE ASH.

DR. HERMANN VON SCHRENK, of the United States Department of Agriculture, in charge of the Mississippi Valley Laboratory at St. Louis, has issued a bulletin describing a disease of the white ash caused by the fungus *Polyporus fraxinophilus*. The disease is prevalent in the Mississippi valley, and is particularly severe in Missouri, Kansas and Nebraska, where this tree reaches its western limit. The disease, which has been named the 'white rot,' changes the hard wood of the tree into a soft, pulpy, yellowish mass, making it unfit for lumber purposes, and bringing about the early death and overthrow of the tree. Accordingly, in regions where this

disease is common the ash never grows to be a very large or very old tree. It is said that in Forest Park, St. Louis, nearly all of the white ash trees are diseased. Susceptibility to the disease, mode of entrance of the parasite, the microscopic changes of the wood, and remedies, are discussed in this bulletin. Five excellent plates serve to make the matter plainer than is possible by text alone.

Charles E. Bessey.

The University of Nebraska.

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### *THE BRAIN OF SILJESTRÖM.*

The brain of Professor Per Adam Siljeström, of Stockholm, has recently been described by Retzius.* Siljeström was an eminent physicist and pedagogue who died in 1892 at the age of seventy-six. He was connected with the Paul Gaimard Polar Explorations, and is best known for his valuable researches on Mariotte's law, and for his efforts in behalf of the reformation of the school systems in Europe. Most of his work in this line was done subsequent to his visit to the United States in 1849–50, where he studied the various school systems and published his views. His intellectual abilities are spoken of as having been of the highest order.

Retzius adds his description of this brain to those of the astronomer Hugo Gylden and the mathematician Mme. Sonya Kovalewski. Siljeström's brain weighed 1,422 grams and is splendidly developed. Its convolutions are particularly rich in the frontal and parietal association areas, and it appears in most respects more complex than do those of Gylden and Kovalewski. The brain shows that special order of normal asymmetry so typical of the higher brains. As in Gylden's and Kovalewski's brain, the right Sylvian fissure proper is shorter (47 mm.) than the left (58 mm.), and the marginal gyre shows a similar complexity; these features are of interest in their possible relation to the mathematical abilities of these persons.

A small abscess of the size of a hazelnut involved the right subfrontal gyre.

E. A. S.

* *Biologische Untersuchungen*, Neue Folge, X., 1902 (Stockholm).

### *THE NEW ALGOL VARIABLE.*

The Algol variable, 4.1903, recently discovered by Mme. Ceraski, proves to be an object of unusual interest. The Carnegie grant has enabled an examination of the photographs, taken with the Draper telescopes, to be made. This has shown that the star has a period of 1.3574 days $= 1^d\ 8^h\ 34^m.7$, and a range of 2.4 magnitudes. About half an hour before minimum, the rate of diminution in light amounts to between two and three magnitudes an hour, and is probably greater than that of any other star yet discovered. A minimum was predicted here, and was observed photographically and photometrically, 1903, March $19^d\ 16^h\ 24^m$, G. M. T.

Edward C. Pickering.

Harvard College Observatory,
March 24, 1903.

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### *SCIENTIFIC POSITIONS UNDER THE GOVERNMENT.*

The Civil Service Commission announces that on May 5, 1903, an examination will be held for the position of assistant physicist. The subjects and weights are:

1. Education and experience..... 50
2. Thesis (each competitor will be required to present a thesis of not less than 2,000 nor more than 2,500 words on some subject appropriate to the line of work indicated by the special subject of the examination below which he proposes to take; thesis to be prepared prior to date of examination and to be given to examiner on that date. In preparation of thesis, competitor may consult such books or publications as he desires, but the thesis must be entirely his own composition and must be accompanied by an affidavit to this effect) ..... 20
3. Any one, *and only one*, of the following four subjects:
   - (*a*) Magnetic testing and research and the absolute measurement of electrical quantities, such as currents, resistances, capacities, inductances, etc.
   - (*b*) Electrical testing and photometry. This includes the testing of instruments used for the measurement of both direct and alternating currents, of the various switchboard, portable,

and laboratory types. Also the photometric testing of incandescent and arc lamps, and such experimental and research work as may be involved in developing methods of testing.

(*c*) Radiation, pyrometry and phytometry. The study of thermal radiation and the determination of high temperatures and luminous intensities by radiation measurements; also the investigation of various standards of light.

(*d*) Mechanics, hydraulics and engineering, especially as applied to the study and testing of gas and water meters, pressure gauges and the various instruments for measuring high and low pressures, anemometers, engine indicators, speed counters and other engineering instruments..... 30

Total .....100

Applicants must show that they have been graduated from colleges or technical schools or that they have attained an equivalent education. A preliminary rating will be made of the first subject as shown by the application and accompanying vouchers, and those competitors who fail to attain at least 70 per cent. on this portion of the examination will not be given a rating on the thesis under the second subject nor the examination test under the third subject. From the eligibles resulting from this examination it is expected that certification will be made to fill four vacancies in the position of assistant physicist in the National Bureau of Standards, two at a salary of $2,200, one at $1,800, and one at $1,600 per annum, and to other similar vacancies as they may occur.

On April 21, 1903, there will be an examination for the position of scientific assistant, the subjects and weights being:

1. College course with bachelor's degree (including a certified statement in detail of courses of study pursued and standing in each) ..... 40
2. Post-graduate course or special qualifications (including a certified statement in detail of courses of study pursued and standing in each)..... 30
3. Thesis, or other literature (on a scientific subject bearing upon the work the applicant desires to pursue)..... 30

Total .....100

Applicants who comply with the preliminary requirements may be examined in one or more of the following subjects. Each of these subjects, however, is rated independently and constitutes a distinct examination in itself: Agricultural statistics; agrostology; chemistry, agricultural; chemistry, analytical, methods for the detection of food adulteration; chemistry, analytical, official methods, except food adulteration; chemistry, analytical, qualitative and quantitative, including analytical chemistry used in connection with important industries; economic botany; entomology; forestry; horticulture (candidates in this subject should state their qualifications for service in Porto Rico and Hawaii); library science; physiology and nutrition of man; plant bacteriology; plant breeding; plant pathology; plant physiology; pomology; rural engineering, especially as applied to irrigation and drainage; seed testing.

From the eligibles resulting from this examination it is expected that certification will be made to the position of scientific assistant in the Department of Agriculture and to other similar vacancies as they may occur.

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### *THE DESERT BOTANICAL LABORATORY.*

THE Desert Botanical Laboratory of the Carnegie Institution will be located at Tucson. Mr. Frederick V. Coville and Dr. D. T. MacDougal, the advisory board of the laboratory, after a trip in January and February through the deserts of Texas, New Mexico, Arizona, California, Chihuahua and Sonora, reported in favor of locating the laboratory at Tucson, and the executive committee of the Carnegie Institution has approved the selection. The actual site of the building is on the shoulder of a mountain two miles west of the city of Tucson. This mountain and the adjoining mesas bear a splendid representation of such characteristic desert forms as *Cereus giganteus, Fouquiera, Opuntia, Echinocactus, Covillea* and *Parkinsonia.*

The officers of the University of Arizona and of the Arizona Agricultural Experiment Station have taken a lively interest in the project and the Tucson Chamber of Commerce expressed its appreciation of the importance of the enterprise by donating the site, installing a water supply, electric connections and rendering other valuable assistance.

Plans for building have been approved and construction will be begun as soon as the site is prepared. It is expected that the laboratory will be ready for operation about September 1, at which time Dr. W. A. Cannon, the resident investigator, will take up his duties.

### *THE U. S. NATIONAL MUSEUM.*

The last Congress appropriated $3,500,000 for a new building with granite fronts for the U. S. National Museum. This will be placed on the mall to the north of the Smithsonian Institution and at a suitable distance from it. Tentative plans for such a building were submitted to Congress in response to a resolution passed at the previous session, but the fortunate change from brick and terra-cotta will necessarily lead to some alterations, particularly in the design for the exterior. The general arrangement of the halls and the amount of floor space will, however, remain practically the same as in the provisional plans. These contemplate a rectangular building, about 480 feet front and 350 feet deep, surrounding two open courts, and about 80 feet high including the basement. The building will afford about 400,000 square feet of floor space, or nearly nine and a half acres, and is designed for four floors, the first and second to be used for exhibition purposes, the basement and upper floor to be for the arrangement of the reserve, or study series, for workrooms and other necessary museum purposes. A special effort will be made to have the offices of the museum staff not only near the study series, but as near as possible to their respective exhibition halls, while the lighting of the exhibition halls will be mainly from the sides, in order to avoid dark corners and reflection.

The construction of the new museum is to be in charge of Mr. Bernard R. Green, who had the supervision of the new building for the Library of Congress. The sum of $250,000 was appropriated for the first year. The preparation of working plans will be proceeded with at once, and it is hoped that contracts for the work may be made early in July so that the building may be commenced as soon as possible.

### *THE APPROPRIATION FOR THE U. S. DEPARTMENT OF AGRICULTURE.*

The appropriation for the current expenses of the United States Department of Agriculture provided by the recent session of Congress covers a total of practically six million dollars—$5,978,100, to be exact. This is an increase of $769,140 (including an emergency appropriation for foot-and-mouth disease) over the appropriation for the present year. During the past five years the amount of the appropriation for the department has increased over two and one quarter million dollars.

The increased funds are for the most part to enable an extension of the work of the department along its present lines rather than to take up new special features. Nearly every bureau and division receives additional funds, but the wording of the appropriation act mentions very few new undertakings. Indeed, the wording is now so comprehensive as to render this unnecessary, and makes the legitimate field of the department cover practically all science as applied to agricultural investigation and practice. One new bureau is recognized—the Bureau of Statistics, which is raised from the grade of division. The scientific staff of the Weather Bureau is increased somewhat, an assistant chief being added, among others, and the bureau is authorized to erect five observatories and to establish cable communication between Block Island and Narragansett Pier, with terminal buildings and equipment at each place. The Bureau of Animal Industry receives an increase of $100,000 for its meat and other inspection work, and an emergency appropriation of $500,000 is placed at the disposal of

the Secretary of Agriculture to stamp out the foot-and-mouth disease and other contagious diseases of animals which may appear. The appropriations for the experiment stations in Hawaii and Porto Rico are increased to $15,000, making them uniform with the appropriation for stations in other states and territories, and $5,000 is appropriated for taking up the farmers' institute work with a view to assisting the organizations in the different states and territories and making them more effective means for the dissemination of the results of the work of the department and of the agricultural experiment stations. A farmers institute specialist, who has had long experience in this line of educational work, has been appointed upon the staff of the Office of Experiment Stations, and will take up the new enterprise in April. The fund for the purchase of seeds for congressional distribution is increased by $20,000, being now $290,000, but an additional $10,000 is allowed to be expended out of this fund for the seed and plant introduction from foreign countries, making the fund for that purpose $30,000.

The items carried by the act for the various bureaus and divisions are as follows: Office of the Secretary, $74,600; Weather Bureau, $1,248,520; Bureau of Animal Industry, $1,287,380; emergency appropriation for foot-and-mouth disease, $500,000; agricultural experiment stations and Office of Experiment Stations (including irrigation investigations and nutrition investigation), $895,000; Bureau of Plant Industry, $674,930 (increase of $62,200); Bureau of Forestry, $350,000 (increase of $58,140); Bureau of Soils, $212,480 (increase of $42,800); Bureau of Chemistry, $85,300 (increase of $15,500); Bureau of Statistics, $156,660 (increase of $15,500); Division of Entomology, $77,450 (increase of $10,000); Division of Biological Survey, $51,850 (increase of $6,000); Division of Publications, $229,320 ($105,000 of which is to be used for the preparation and printing of Farmers' Bulletins); Division of Foreign Markets, $16,000; Public Road Inquiries, $35,000; Library, $20,000; Division of Accounts, $24,350; contingent expenses, $37,000; Museum, $2,260.

This statement does not include the funds available for printing the publications of the department, which are carried by another appropriation.

Congress also gave authority for the erection of suitable buildings for the department, to cost not exceeding $1,500,000, and $250,000 was appropriated for the work to be done on these buildings during the coming year.

The total appropriations made by the Fifty-seventh Congress for the department aggregate $12,005,133.80.

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## *SCIENTIFIC NOTES AND NEWS.*

THE American Museum of Natural History announces the appointment of Dr. Livingston Farrand, of Columbia University, as assistant curator of ethnology, and of Professor William Morton Wheeler, now of the University of Texas, as curator of invertebrate zoology.

PROFESSOR ANDREW C. MCLAUGHLIN, who has filled the chair of American history at the University of Michigan since 1891, has been selected by the trustees of the Carnegie Institution to organize a bureau of historical research and to direct its investigations. Professor McLaughlin has been given a leave of absence from the University of Michigan for the coming college year in order that he may take up this new work. The larger part of the investigations will be carried on in connection with the government archives at Washington.

THE daily papers state that Professor Raphael Pumpelly, of Newport, R. I., has gone to Turkistan to make explorations under the auspices of the Carnegie Institution.

DR. WILHELM BAUERS, of the Royal Ethnological Museum, Berlin, is at present at Mexico studying the native tribes.

PROFESSOR VOLNEY M. SPALDING, head of the botanical department of the University of Michigan, has been granted leave of absence by the board of regents for the next academic year. He will devote the time largely to studies of plant distribution, visiting various European collections and traveling elsewhere.

IN harmony with the invitation received from the German government, the Secretary

of State, acting on the nomination of the Secretary of Agriculture, has issued the necessary credentials appointing Dr. H. W. Wiley, chief of the Bureau of Chemistry, U. S. Department of Agriculture, the official representative of the United States at the Fifth International Congress of Applied Chemistry, to be held at Berlin on June 8, 1903. Dr. Wiley has acted in this capacity at each of the four preceding congresses and his wide acquaintance with European men of science, as well as his international reputation as a chemist, fit him preeminently to discharge the obligations of this post with honor to the United States. The details of organization of this congress are to be found in SCIENCE for February 20, on page 315.

IT is expected that Dr. Walter Nernst, professor of electrochemistry at the University at Göttingen, will visit the United States this month.

THE Bessemer gold medal of the Iron and Steel Institute of Great Britain has been awarded to Sir James Kitson, M.P., past-president, in recognition of his great services to the iron and steel industry of Great Britain. The presentation of the medal will be made by Mr. Andrew Carnegie at the annual meeting on May 7.

PROFESSOR WOODHEAD and Dr. Anningson have been appointed representatives of Cambridge University at the congress of the Royal Institute of Public Health to be held at Liverpool in July next.

MR. WILLIAM WEBER COBLENTZ, graduate scholar in physics, at Cornell University, has been appointed to a research assistantship by the Carnegie Institution. Mr. Coblentz will continue his investigations, already well advanced, of absorption spectra in the infra-red. The work will be done in the Physical Laboratory of Cornell University.

DR. F. S. WRINCH, at present demonstrator in experimental psychology at Princeton University, has been appointed to a research assistantship in psychology by the Carnegie Institution.

SEBASTIAN ALBRECHT, graduate student in the University of Wisconsin, has been appointed to a fellowship in astronomy at the Lick Observatory.

THE coming commencement season will complete the twenty-fifth year of President G. Stanley Hall's philosophical doctorate, taken at Harvard in 1878. It has seemed to a number of his colleagues and former students that this occasion should not be allowed to pass unnoticed, but on the contrary, should be marked in a manner commensurate, in some degree, with President Hall's service to psychology and its teaching in this country. The form which will accomplish this end in a way most agreeable to President Hall himself is the publication of a worthy *Festschrift* in his honor. Professor E. C. Sanford, of Clark University, and Professor E. B. Titchener, of Cornell University, as co-editors with President Hall of the *American Journal of Psychology*, which he founded in 1887, have, therefore, decided to invite contributions from a number of his colleagues and the more actively productive of his past students, and will see the collection of papers through the press.

MR. G. T. WALKER, a recent senior wrangler at Cambridge, has been appointed head of the Indian Meteorological Department.

DR. JAMES J. DOBBIE, professor of chemistry and geology in the University College of North Wales, has been appointed director of the Museum of Science and Art, Edinburgh, in succession to F. Grant Ogilvie, Esq., who has been appointed a principal assistant secretary under the Board of Education at South Kensington.

AT the monthly general meeting of the London Zoological Society on March 20, Mr. W. L. Sclater was officially proposed as secretary in succession to his father, Dr. Sclater, who retired in January. At the instance of those opposed to Mr. Sclater's election a meeting of the fellows was held on March 20, at which Mr. Chalmers Mitchell was nominated for secretary. The election will take place on April 29.

DR. DAVID STARR JORDAN, of Stanford University, gave the principal address at the exercises commemorating the thirty-fourth anniversary of the University of California, his

subject being 'American University Tendencies.'

DR. F. A. WOLFF, of the National Bureau of Standards, Washington, will discuss 'Modern Methods of Electrical Standardizing' before the Franklin Institute of Philadelphia on March 26.

THE winter term public meeting of the Ohio State University Chapter of the Society of the Sigma Xi was addressed this year by Professor C. B. Morrey, his subject being the 'Uses of Bacteria.' Of especial interest was the elaboration of the author's theory of the bacterial formation of coal and natural gas.

MR. CHARLES A. DAVIS, instructor in forestry, in the University of Michigan, has been engaged to prepare a map showing the distribution of forest trees and soil relations for the Ann Arbor sheet of the topographic atlas soon to be published by the United States Geological Survey.

CABLEGRAMS to the daily papers from New Zealand report the return of the *Morning* which joined the *Discovery* on January 23. The latter ship wintered further south than any previous expedition and Captain Scott with a sledging party penetrated one hundred miles further south than any previous explorer. An extensive mountainous region was discovered, which it is supposed may extend to the South Pole. Two other exploring parties are also said to have made important geographical discoveries. Large collections and numerous observations have also been made. The *Discovery* is expected to return in August.

IT is stated in the London *Times* that M. Bialynitsky-Biroulin, the zoologist, who was a member of Baron Toll's Arctic expedition, has given the Irkutsk branch of the Russian Imperial Geographical Society the following information regarding Baron Toll, who left for Siberia in June last to explore Bennett Land and has not been heard of since. M. Biroulin says that he left Baron Toll at Neupoloch Bay on May 11 and proceeded to New Siberia, where he arrived a fortnight later. He left the island on December 4. Before his departure he erected a hut as a depository for the flesh of thirty reindeer and other preserved food. Baron Toll, M. Biroulin states, left the yacht *Sarja* on June 9 on the islands of the north coast and proceeded to Cape Wyssoki, where he arrived on July 10. Here he deposited a statement to the effect that all was well with him and his followers and that the dogs were in good condition, having had sufficient reindeer meat. Baron Toll started for Bennett Land on July 13 with three sleighs and 45 dogs. If a passage through the ice to the *Sarja* should not be open, M. Biroulin said that Baron Toll intended wintering in Bennett Land.

THE Rev. Dr. John Peate, of Greenville, Pa., known for the reflecting telescopic lenses that he has made while engaged in other work, died on March 24, at the age of eighty-two years.

THE death is announced of M. Gustav Radde, director of the Museum at Tiflis, known for his studies of the natural history of the southwestern Caucasian region.

M. VORONINE, professor of botany in the University of St. Petersburg, has died at the age of seventy-five years.

A TELEGRAM has been received at the Harvard College Observatory from Professor Kreutz, at Kiel, stating that a new star, which is possibly a variable, has been found by Professor Turner, at Oxford. The magnitude was 8.0 on March 16. This object is confirmed on a Harvard photograph taken on March 6, 1903. Invisible on plate and certainly fainter than tenth magnitude on March 1, 1903. A telegram from Professor Geo. E. Hale, at Yerkes Observatory, states that Turner's new star is in the following position. March 27.75 G. M. T., R. A. $6^h\ 37^m\ 49^s.0$ Dec. $+30°\ 02'\ 38''$. Its color is red and its spectrum shows bright lines or bands.

THE American Social Science Association will meet at Boston on May 14, 15 and 16.

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## *UNIVERSITY AND EDUCATIONAL NEWS.*

THE late Ario Wentworth, of Salem, Mass., has made numerous public bequests, including $100,000 to the Massachusetts Institute of Technology, $100,000 to the Massachusetts

Society for the prevention of cruelty to animals and $10,000 to Bates College. The residue of the estate, subject to certain annuities, is to be used for the establishment of an industrial school to be known as the Wentworth Institute. The daily papers state that the estate is valued at $7,000,000.

Mr. Andrew Carnegie has presented to Aberdeen University, of which he is lord rector, nine acres of land as a recreation ground for the students.

Dr. S. M. Lindsay, commissioner of education for Porto Rico, has introduced in the executive council a bill establishing a University of Porto Rico. The institution would be supported by taxation, but it is hoped that it would also receive private gifts and bequests.

Columbia University will on October 31, 1904, celebrate the hundred and fiftieth anniversary of its foundation as King's College.

Representatives from the principal universities and colleges of New York state met on March 26, at Columbia University, to determine the basis upon which the award of the two Rhodes scholarships for New York state should be made. It was decided that in the state of New York the administration and award of the scholarships shall be intrusted to a committee of three, to be elected by the heads of the colleges for men. The committee will consist of President Butler, three years; President Schurman, two years; Chancellor Day, one year. The conference decided that the conditions regulating the award shall be as follows:

> The candidates for the scholarships to be eligible shall have satisfactorily completed the work of at least two years in some college of liberal arts and sciences in the State. Except under extraordinary circumstances, the upper age limit shall be twenty-four years at the time of entering upon the scholarship at Oxford. To be eligible, the candidate shall be a citizen of the United States or the son of a citizen, and must be unmarried.

Dr. D. F. O'Connell, the new rector of the Catholic University at Washington, has arrived in this country and it is expected that he will be installed during the present month.

Filibert Roth, formerly assistant professor of forestry at Cornell University, and later chief of Forest Reservations in the Department of the Interior, has been appointed professor of forestry in the University of Michigan.

Dr. Frederick De Forest Heald, now professor of biology in Parsons College, Iowa, has been elected adjunct professor of plant physiology and general bacteriology in the University of Nebraska.

At Teachers College, Columbia University, Mr. Louis Rouillion has been advanced to the rank of adjunct professor of manual training, and Dr. Maurice A. Bigelow to that of adjunct professor of biology (in charge of zoology).

Dr. Charles W. Shields, professor of the harmony of science and revealed religion, Princeton University, has resigned. Dr. Shields is seventy-eight years of age.

Mr. Robert E. Bruce, now at Pomona College, California, has been appointed instructor in mathematics in Boston University.

Dr. J. Venn, F.R.S., known for his contributions to logic and scientific method, has been elected president of Gonville and Caius College, Cambridge.

The University Court of St. Andrews University has appointed Mr. Bernard Bosanquet, M.A., LL.D., formerly fellow and lecturer of University College, Oxford, to the chair of moral philosophy, in room of Professor William Knight, who has resigned.

Mr. V. J. Wooley, a student of physiology, has been elected fellow of King's College, Cambridge.

Mr. Arthur Edwin Boycott, B.Sc., M.A., has been elected to a fellowship at Brasenose College, Oxford, after an examination in animal physiology.

Sir Michael Foster, M.P., who has held the professorship of physiology at Cambridge since its establishment in 1883, has placed his resignation in the hands of the vice-chancellor.

Professor Laurie, who has held the chair of education in the University of Edinburgh since 1876, has intimated his resignation.